



Determine the Optimal Levels of Bio-fertilizers and Foliar Application of Iron on Yield and Quality Indices of Roselle (*Hibiscus sabdariffa* L.)

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Introduction

In conventional agricultural systems to obtain the highest performance continuous use of chemical fertilizers is inevitable. The health of the plant, soil and living matter depends on the rotation of food elements in the ecosystem. This cycle is disrupted as a result of the loss of soil fertility, its food imbalance and inappropriate cultivation practices. Bio-fertilizers are composed of beneficial microorganisms, each for a specific purpose, such as nitrogen fixation, release of phosphate ions, potassium, iron. It should be noted that most studies in the field for sour Roselle (*Hibiscus sabdariffa*) are based on the use of various chemical fertilizers, but the reaction of this plant to bio-fertilizers and iron solubilization has not been considered. Therefore, this study aimed to investigate the effect of bio fertilizers and iron on yield and quality traits of Roselle in hot and dry weather conditions.

Materials and Methods

In order to investigate the effects of bio-fertilizers and foliar application iron on yield and quality indicators Roselle (*Hibiscus sabdariffa*) experiment in Research field of Zabol University Agriculture Institute in 2015-2016 years was performed with split-plot based on completely randomized design and three replications. Treatments consisted of four levels of bio-fertilizers: control (without fertilizer), vermicompost, cow manure, seaweed and iron foliar applications include: lack of iron, foliar application at a rate of 3cc per thousand, 6cc per thousand was considered. As a source of bio-fertilizer treatments and foliar application iron levels were considered as sub plots. Before sowing Roselle seeds, vermicompost and manure were added to the soil and inoculation operation. Measurements were: economic yield, biological yield, harvest index, chlorophyll a, b and carotenoids, anthocyanins, carbohydrates and protein. Statistical analysis of data was done with SAS software version 9.1 and mean comparison with Duncan test was conducted at 5%.

Results and Discussion

Based on the results, different levels of foliar application of organic manure and their interaction were significant for all traits except harvest index. The highest Roselle economy yield of 587.6 kg per hectare with consumption of 6 cc per thousand iron and seaweed bio-fertilizer foliar application was obtained This amount increased by 73% compared to the control (355.3 kg^{ha-1}) and highest amount of sepals anthocyanins (8.960) in treatment 3 cc per thousand iron and manure was obtained, and concentration of 6 per thousand iron and vermicompost and seaweed bio-fertilizers increased chlorophyll a, b and carotenoids were also foliar application iron concentration of 6 per thousand increase amount of carbohydrates and protein were twigs. Comparison of means in interaction of bio-fertilizers and iron showed that the highest increases in chlorophyll a, in application of vermicompost and there is a concentration of 6 per thousand iron and the highest increases in chlorophyll b, by the same application seaweed and iron concentration was 6 per thousand. The highest amount of protein

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was obtained from seaweed treatments that have shown an increase compared to control by about 61%. Foliar application of iron increases protein of Roselle so that the highest amount of concentration was 6 per thousand and compared to control treatment the increase was about 52 percent.

Conclusion

The results of this study indicated that the combination of biofertilizer and iron solubilization with a concentration of 6,000 has the greatest impact on quantitative and qualitative properties. Accordingly, the combined application of bio fertilizers and iron spraying has a significant advantage over the individual application of each one of them. Iron foliar treatments have put this element directly at the plant and by supplying these elements the plant needs are eliminated and the most of the measured traits increased. Also, considering the important role of biofertilizers in improving the physical, chemical and fertility characteristics of arable land, providing appropriate levels of these materials in the soil helps to achieve maximum performance. Accordingly, fertilizer management with biological fertilizers and iron foliar application is an important part of organic agriculture.

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Keywords: Anthocyanin, Chlorophyll, Foliar iron, Roselle, Seaweed

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