Sudan J. Des. Res. Vol. 12 (1) :130-137, 2020

A Note: Influence of Soil and Foliar Aplication of Two Iron Sources on Iron Chlorosis in Ixora (*Ixora coccinea* L.) Plant*

Seifeldin Ali Mohamed[1] and Alobaid Daffalla Alobaid Hamad[2]

Department of Horticulture Faculty of Agriculture University of Khartoum

Abstract: The objective of this research was to study the effect of two iron sources and their application methods in correcting iron chlorosis in Ixora (*Ixora coccinea* L.) plants . The plants were treated with five treatments, namely, soil application of Fe EDDHA, phenolic acid chelated iron separately at 0.15g Fe per pot , foliar application of Fe EDDHA, phenolic acid chelated iron separately at 0.4g Fe / L and the control. Results indicated that there were significant differences between the treatments as indicated in the percentage of green leaves per plant, leaf Fe content and leaf chlorophyll content. Soil application of Fe EDDHA gave the highest percentage of green leaves per plant and the highest leaf Fe content. The highest value of leaf chlorophyll content was obtained by foliar application of Fe EDDHA. In conclusion, treatment with the two iron sources had a positive effect in correcting Fe chlorosis in ixora plants and soil application of Fe EDDHA was the best treatment.

Key words: *Ixora coccinea* L.; Iron chlorosis; Fe EDDHA; Phenolic acid chelated iron

Ixora (*Ixora coccinea*) known as Jungle flame, common throughout the tropics, is a genus of about 400 species of evergreen flowering shrubs and small trees belonging to the family Rubiaceae. It is popular because of its hardiness and its color separation and its adaptability rate compared to other species (Adetimirin, 2008). It is an attractive landscape plant used as a flowering hedge or screen, a border plant, a pot plant and for general color effect (Musa, 2008). It is an acid-loving plant and a pH around 5 is

* Part of an M.Sc. thesis presented to the University of Khartoum by the second author

[1] Assoc. Professor, Dept. of Horticulture, Faculty of Agriculture, Univ. of Khartoum

[2] Former graduate student

good for it (Keeler,*et al*. 2003). It develops iron chlorosis when grown in soils that are highly alkaline (Anonymous, 2020). Alkaline soils with a pH of 7.4 or more can induce deficiencies of minor elements such as iron and zinc in plants vulnerable to such deficiencies (Wong, 2005). Iron has a function in various cellular processes such as respiration, cell division, reduction steps of important biological events, such as transpiration, photosynthesis, and chlorophyll biosynthesis (Zocchi *et al.*, 2007). Chlorosis is an interveinal yellowing of new leaves that can be temporarily corrected by applications of chelated iron to the foliage or the soil (Raymond,1998). Iron chlorosis can be controlled when plants are supplied with foliar fertilizer or added to the soil as a drench. The most lasting result is obtained through treating soil with Fe EDTA in various forms (Nancy, 1996). In Sudan, where most soils are alkaline, *Ixora coccinea* exhibits severe yellowing or chlorosis of the leaves, therefore, losing their landscape value. The objective of this research was to evaluate the effect of two iorn sources and their application methods in correcting chlorosis in Ixora *(Ixora coccinea* L.*)* Plants. A pot experiment was carried out at the ornamental plants nursery of the Department of Horticulture, Faculty of Agriculture, University of Khartoum at Shambat, Sudan. (Latitude 15° 40` N, longitude 30° 32` E) during September 2015-June 2016. Ixora transplants were transplanted into 8 liters plastic pots each filled with ten kg of field soil collected from the field of the Department of Horticulture, Faculty of Agriculture, University of Khartoum. After six months of growth all plants showed symptoms of chlorosis. Chlorotic plants where fertilized every month with the following treatments:

- soil application of 0.15g Fe per 8 L pot using Fe EDDHA.
- Foliar application of o.4g Fe/L using Fe EDDHA.
- soil application of 0.15g Fe per 8 L pot using phenolic acid chelated iron.
- Foliar application of o.4g Fe/L using phenolic acid chelated iron.
- Control (no fertilizer).

The parameters measured were percentage of green leaves/plant, leaf chlorophyll and iron (Fe) contents. Leaf chlorophyll content was determined according to Harborne (1973) method. Leaf iron (Fe) content was measured by Perkins Elmer Atomic absorption spectrophotometer (Annonymous, 1996). A completely randomized design was used, three

plants represented an experimental unit, and each experimental unit was replicated four times. Statistical analysis was carried out using the SPSS program, mean separation was carried out using Duncan's Multiple Range Test at 5% level of significance.

Table (1) shows the effects of the methods of application on percentage of green leaves per plant. The results revealed that percentage of green leaves per plant was significantly affected ($P \leq 0.05$) by the different types and methods of application at 4, 8 and 12 weeks after transplanting. Soil application of Fe EDDHA gave the highest Percentage of green leaves per plant followed by foliar application of Fe EDDHA. These results are in line with those of Broschat (2003), who reported that soil application of Fe EDDHA to the alkaline substrate, resulted in a significant correction of chlorosis in dwarf ixora. In sunflower, peach and pear crops application of the synthetic Fe (III)-chelates (EDDHA/Fe^{3+}, EDDHMA/Fe^{3+} and EDDHSA/Fe^{3+}) was enough to cause a visible full recovery from iron-deficiency (Álvarez-Fernández *et al.*, 2005).

Table (1): Effect of Iron fertilization treatments on percentage of green leaves per plant at 4, 8 and 12 weeks after transplanting.

Treatment	Weeks after transplanting		
	4	8	12
	%		
Control (No fertilizer)	5.29	1.98	0.00
Soil application of Fe EDDHA	46.54	56.08	70.79
Foliar application of Fe EDDHA	39.37	51.28	66.82
Soil application of phenolic acid chelated iron.	5.62	6.01	3.73
Foliar application of phenolic acid chelated iron.	14.03	8.30	2.50

Table (2) shows the effects of different types and methods of application on Fe content in Ixora plant. The result showed that Fe content in plant was significantly ($P \leq 0.05$) affected by the source and the method of application at 12 weeks after transplanting. Soil application of Fe EDDHA gave the highest Fe content followed by foliar application of phenolic acid chelated iron and soil application of phenolic acid chelated iron and control respectively, while foliar application of Fe EDDHA gave the lowest Fe content. In Spathiphyllum plant, foliar application of Fe EDDHA resulted in higher plant Fe content than soil application of the same fertilizer and the control (Mohamadipoor *et al*., 2013). Genotypic and experimental conditions differences might be responsible for such variation in results.

Table (2): Effect of Iron fertilization treatments on Fe content (ppm) in Ixora plant at 12 Weeks after transplanting.

Treatment	Fe content (ppm)
Control (No fertilizer)	604.41^{b}
Soil application of Fe EDDHA	1122.12^{a}
Foliar application of Fe EDDHA	519.15^{b}
Soil application of phenolic acid chelated iron	690.76^{ab}
Foliar application of phenolic acid chelated iron	758.65^{ab}

Means followed by the same letter "s" in the same column are not significantly different (P = 0.05) according to Duncan's Multiple Range Test.

Table (3) shows the effects of Fe source and method of application on Chlorophyll content in Ixora plant. Results showed that chlorophyll content was significantly affected ($P \leq 0.05$) by the different types and methods of application at 12 weeks after transplanting. All treatments were significantly higher than the control. Foliar application of Fe EDDHA gave the highest chlorophyll content. These result are

comparable with those of Mohamadipoor *et al*. (2013), who found the highest chlorophyll content with Fe EDDHA treatment.

Table (3): Effect of Iron fertilization treatments on chlorophyll content (mg/g) in Ixora plant at 12 Weeks after transplanting.

Treatment	Chlorophyll content (mg/g)
Control (No fertilizer)	6516.09[b]
Soil application of Fe EDDHA	9940.44[a]
Foliar application of Fe EDDHA	10158.03[a]
Soil application of phenolic acid chelated iron	9551.29[a]
Foliar application of phenolic acid chelated iron	8566.08[a]

Means followed by the same letter "s" in the same column are not significantly different (P = 0.05) according to Duncan's Multiple Range Test.

REFERENCES

Adetimirin V. O., Kim S. K., Szczeeh M. 2008. Factors associated with emergence of ornamental flowers. Journal of Agricultural Science 144 (1): 68-72.

Álvarez-Fernández, A., García-Marco, S. and Lucena, J. J. 2005. Evaluation of synthetic iron (III)-chelates (EDDHA/Fe3+, EDDHMA/Fe3+ and the novel EDDHSA/Fe3+) to correct iron chlorosis. European Journal of Agronomy 22 (2): 119–130.

Anonymous, 1996. Analytical Methods for Atomic Absorption Spectroscopy. The Perkin-Elmer Corporation. http://www1.lasalle.edu/~prushan/Intrumental%20Analysis files/AA-Perkin%20Elmer%20guide%20to%20all!.pdf

[Accessed 12 February 2020].

Anonymous, 2020. Description for Ixora Long, Singapuri Ixora (Pink). https://etree.pk/Plant/ixora-long-singapuri-ixora-pink. Accessed: 19 February 2020.

Broschat, .T. K. 2003. Effectiveness of Various Iron sources for correcting Iron Chlorosis in Dwarf Ixora. HortTechnology 13(4): 625-627.

Keeler, G.; Gabel, K. and Schoellhorn, R. 2003. Ixora for South Florida. University of Florida, IFAS Extension.http://ufdcimages.uflib.ufl.edu/IR/00/00/17/45/00001/EP16400.pdf. [Accessed July 19, 2018].

Harborne J.B. 1973. *Phytochemical Methods (A guide to modern techniques of plant analysis).* Fakenham Press Limited Fakenham, Norfolk.

Mohamadipoor, R.; Sedaghathoor, S. and Khomami, A. M. 2013. Effect of application of iron fertilizers in two methods 'foliar and soil application' on growth characteristics of *Spathyphyllum illusion*. European Journal of Experimental Biology 3(1): 232-240.

Musa T. S. A. 2008. *Causes of Chlorosis in Ixora Plants (Ixora coocinea, L.) in specific sites in Khartoum and Kenana, Sudan.* Msc thesis, University of Khartoum Faculty of Agriculture Department of Horticulture.

Nancy R, P. 1996. *Iron chlorosis of woody plants: Course and control*. College of Agricultural Consumer and Environmental Sciences, Report. RPD No. 603. University of Illinois Extension.https://web.extension.illinois.edu/forestry/publications/pdf/forest_health/UIUC_Iron_Chlorosis.pdf. [Accessed August 26, 2018].

Raymond B., 1998. *Fertilizing Landscape Trees and Shrubs.* Home and Garden Information

Center.UniversityofMaryland.http://extension.umd.edu/sites/extension.umd.edu/files/_images/programs/hgic/Publications/HG23%20Fertilizing%20Landscape%20Trees%20&%20Shrubs.pdf. [Accessed September 13, 2018].

Wong, M. 2005. *Visual symptoms of plant nutrient deficiencies in nursery and landscape plants. Soil and Crop Management CSM-10*, University Hawaii Department of Tropical Plant and Soil Science. https://www.ctahr.hawaii.edu/oc/freepubs/pdf/SCM-10.pdf. [Accessed September 13, 2018].

Zocchi, G., De Nisi P., Dell'Orto M., Espen L., Gallina P.M. 2007. Iron deficiency differently affects metabolic responses in soybean roots. Journal of Experimental Botany 58(5): 993–1000.

تأثير الاضافة في التربة والرش الورقي لمصدرين للحديد على الاصفرار الناتج من نقص الحديد(*Ixora coccinea* L.) في نبات الاكزورا*

سيف الدين علي محمد[1] و العبيد دفع الله العبيد[2]

قسم البساتين، كلية الزراعة، جامعة الخرطوم، شمبات، السودان

المستخلص: هدف البحث لدراسة تاثير مصدرين للحديد و طريقة اضافتهما على معالجة الاصفرار الناتج من نقص الحديد في نبات الاكزورا. عوملت النباتات بخمس معاملات و هي اضافة في التربة بمعدل 0.15 جرام حديد لكل أصيص كل على حدة رش ورقي ل 0.4 جرام حديد لكل لتر باستخدام Fe EDDHA و phenolic acid chelated iron كل على حدة والشاهد. أظهرت النتائج أن هنالك فرق معنوي بين المعاملات وظهر جليا في النسبة المئوية للأوراق الخضراء في النبات الواحد، محتوى الأوراق من الحديد ومحتوى الأوراق من الكلوروفيل. إضافة Fe EDDHA للتربة أعطت أعلى نسبة مئوية للأوراق الخضراء في النبات و أعلى محتوى للأوراق من من الحديد. أعلى محتوى للأوراق من الكلوروفيل نتج من الرش الورقي ل Fe EDDHA. كخاتمة فإن المعاملة بمصدري الحديد كان لها أثر ايجابي في معالجة الاصفرار الناتج من نقص الحديد و كانت اضافة Fe EDDHA للتربة أفضل المعاملات.

*جزء من اطروحة ماجستير قدمت لجامعة الخرطوم بواسطة المؤلف الثانى

[1]بروفسر مشارك، قسم البساتين، كلية الزراعة، جامعة الخرطوم.

[2]طالب دراسات عليا سابق.