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Research Article

Remove (Boron) from Irrigation Water by Using Duckweeds (*Spirodela polyrhiza*)

Zohuir Al Balawna[1]*, Ala Al Khateeb[2], Othman Saleh[2], Mohammad Al Hadeedi[2] , Mohammad Enemat[2] and Notaya Ittichinbanchon

[1]*Head of Lab Division, Jordan Valley Authority Labs, Dair Ulla, Jordan*

[2]*Lab Technician, Jordan Valley Authority Labs, Dair Ulla, Jordan*

***Corresponding Author:** Zohuir Al Balawna, Head of Lab Division, Jordan Valley Authority Labs, Dair Ulla, Jordan.

E-mail: Zohuire_Albalawna@mwi.gov.jo

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Abstract

The objectives of this study were to analyses Boron in growth media contain boron concentration1.5 ppm, 1.5 ppm and 2.5 ppm which covered by duckweeds (*Spirodela polyrhiza*) and other media contain only boron standard 0.5 ppm, 2.5 ppm and 1.5 ppm without duckweed.

All Growth media were analyzed by using spectrophotometer technique at wave length 420 nm by taking different samples of growth media contain boron only, and other growth media contain boron with duckweeds (*Spirodela polyrhiza*).

We show in this study, Boron is decrease in first media media which contain duckweeds (*Spirodela polyrhiza*) by the time from 2.5 ppm to 1.55 ppm, second media media Boron is decrease from 1.5 ppm to 1.04 ppm third media from 0.50 ppm to 0.27 ppm.

Keywords: Boron; *Spirodela polyrhiza*; Duckweed

Introduction

Jordan faces significant challenges in water sources where it became one of the poorest countries in the world in water, and the most prominent of these challenges is the inability of the available water resources to meet the growing water demand. Jordan's per capita share of water is one of the lowest ratios in the world; it decreased over the last several years to reach less than 100 m^3.

The demand for water is increasing year after year. In contrast, water resources are deteriorating continuously in terms of both quality and quantity. The ratio of fresh water used in agriculture is decreasing in each day against the increasing demands of the other sectors. For sustainable agricultural production, low quality waters should also be used in agricultural irrigations. Turkey is quite rich in boron reservoirs. Ground and surface water resources around these reservoirs are contaminated with boron compounds. Use of these sources is a highly significant issue for efficient use of limited water resources.

Boron uptake by plants is controlled by the boron level in soil solution rather than the total boron content in soil. Boron uptake is a passive (non-metabolic) process. It moves with water in plant's tissues and accumulates in the leaves; therefore, Boron uptake and accumulation are directly dependent on the rate of transpiration.

The highest naturally occurring concentrations of soil B are in soils derived from marine evaporites and marine argillaceous sediment. In addition, various anthropogenic sources of excess B may increase soil B to levels toxic for plants. The most important source is irrigation water, but others include wastes from surface mining, fly ash, and industrial chemicals.

Lemnoideae is a subfamily of flowering aquatic plants, known as duckweeds, water lentils, or water lenses. They float on or just beneath the surface of still or slow-moving bodies of fresh water and wetlands. Also known as "bayroot", they arose from within the arum or aroid family (Araceae), so often are classified as the subfamily *Lemnoideae* within the family Araceae. Other classifications, particularly those created prior to the end of the 20th century, place them as a separate family.

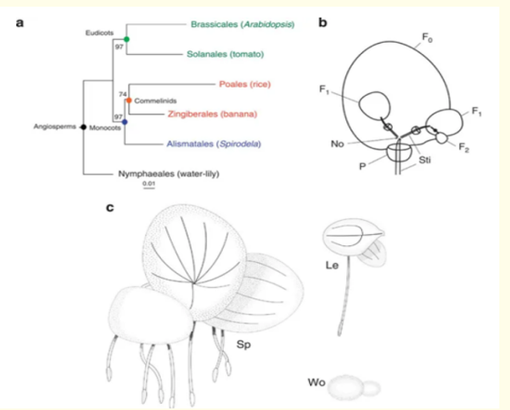

Figure 1

Methodology

Sample collection

Collection duckweeds (*Spirodela polyrhiza*) from lake in farm located in Jordan valley with demand area 25 and farm unit 189 and let it grow in beaker 1 liter in Jordan valley laboratories and collect the sample daily up to 5 days as in table 1.

Period time	Growth media 2.5 ppm		Growth media 1.5 ppm		Growth media 1.5 ppm	
	No duckweeds	With duckweeds	No duckweeds	With duckweeds	No duckweeds	With duckweeds
1 day	3 sample	3 sample	3 sample	3 sample	3 sample	3 sample
2 day	3 sample	3 sample	3 sample	3 sample	3 sample	3 sample
3 day	3 sample	3 sample	3 sample	3 sample	3 sample	3 sample
4 day	3 sample	3 sample	3 sample	3 sample	3 sample	3 sample
5 day	3 sample	3 sample	3 sample	3 sample	3 sample	3 sample

Table 1: Growth medias.

Preparation of samples

Taken 3x 10 ml from every growth media through the time then filtered (using Whatman 15 filter paper),

All samples were immediately analyzed within 1 hr after sample preparation.

Method of analysis

Reading samples by using method: Azomethine H colorimetric method for determining dissolved boron in water by spectrophotometer type perkinelmer at 420 nm.

Digestion samples

The sample duckweeds (Spirodela polyrhiza) tissues was digested by using wet digestion method, one gram of sample taken into keddahs flask having the 1000cm^3 capacity and the sample was digestion in 3:1 ratio of HCl and HNO_3 and leave for a whole day inside a fume hood. The mixture heated for 40°C for more than half hour, the heat was increased up to 100°C and heating continued till the solution become clear, and the white fumes disappeared indicates the completion of the digestion process.

The digestion solution diluted with distilled water and boiled about 15minutes. The solution was cooled, and filter using Whatman filter paper and filled till the mark of keddahs flask using distilled water. The digested solution transferred into a polyethylene bottle for further analysis of heavy metal concentration using atomic absorption [1-17].

Results and Discussion

Boron concentration of growth media (1), growth media (2) and growth media (3) in table 2,3 and 4.

Which analysis by using spectrophotometer at 420 nm, samples collected from medias which prepared in laboratories as show in table 1.

- In media (1), boron is absorbed by duckweed, so it decreases from 2.5 ppm to 1.25 ppm after 5 days.
- In media (2) boron is absorbed by duckweed so it decreases from 1.5 ppm to 0.81 ppm after 5 days.
- In media (3) boron is absorbed by duckweed so it decreases from 0.50 ppm to 0.27 ppm after 5 days.

Analysis the Tissues of duckweeds (*Spirodela polyrhiza*) show increasing in boron.

- Boron concentration in duckweeds (*Spirodela polyrhiza*) tissues for media (1) was 10.8 ppm.
- Boron concentration in duckweeds (*Spirodela polyrhiza*) tissues for media (2) was 5.80 ppm.
- Boron concentration in duckweeds (*Spirodela polyrhiza*) tissues for media (3) was 2.70 ppm.

Period time	B (ppm) level	
	No duckweeds	With duckweeds
1 day	2.54	2.44
2 day	2.51	2.32
3 day	2.45	2.1
4 day	2.46	1.81
5 day	2.42	1.25

Table 2: Boron concentration in media (1).

2.5 ppm Boron.

Period time	B (ppm) level	
	No duckweeds	With duckweeds
1 day	1.55	1.42
2 day	1.52	1.34
3 day	1.52	1.25
4 day	1.49	1.13
5 day	1.47	0.81

Table 3: Boron concentration in media (2)

1.5 ppm Boron.

Period time	B (ppm) level	
	No duckweeds	With duckweeds
1 day	0.51	0.47
2 day	0.5	0.42
3 day	0.49	0.38
4 day	0.47	0.32
5 day	0.46	0.27

Table 4: Boron concentration in media (3).

0.50 ppm Boron.

Conclusions

The study shows decreasing in boron level in growth media and plant increase in plant tissues of duckweeds (*Spirodela polyrhiza*) by using spectrophotometer at wavelength 420 nm.

The higher concentration of boron in irrigation water is became toxicity for most of plant cover irrigation water b y using duckweeds (*Spirodela polyrhiza*) to remove boron from water and became safe to irrigate and safe to plant health.

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