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THE ROLE OF NITROGEN AND BORON FERTILIZERS ON GROWTH AND YIELD IN POMEGRANATE (*PUNICA GRANATUM* L.)

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Abstract

The experiment was conducted in a private field of Sulaymaniyah province (Iraq), the pomegranate trees (Salimi cultivar) was used with six years in the season of 2017. To study the effect of nitrogen and boron in growth and yield of pomegranate. The trees were fertilized with three nitrogen levels in urea form $CO(NH_2)_2$ at a concentration of (0, 10, 15 g.L^{-1}) and three levels of boron using boric acid (17% B) as a source of boron with concentrations of (0, 20, 40 mg.L^{-1}). The experiment was conducted using (R.C.B.D), each treatment has three replicates, the data was analyzing according to Duncan Test at 0.5%.

Key words : Pomegranate, nitrogen, boric acid, TSS, nutrition.

Introduction

Pomegranate tree (*Punica granatum* L.), which belongs to the Punicaceae family, is considered the fruit of the subtropical regions. Iran is the original country of pomegranates (Yousef, 2002), the Mediterranean regions and Iraq, Lebanon, Syria, Palestine, pomegranates transported to the North Africa ,Spain, Italy, Greece and Mexico by Arabs during the dilation, which moved to Europe and the United States of America (Abu Aziz, 1982). The economic importance of the pomegranate fruits has a long growth season which its presented in the markets. The maturity of the fruits starts from the late summer until the middle of the winter, in same period, Its nutritional value comes through the containment of the fruit to a good proportion of vitamins and minerals. The pomegranate cultivation is successful in Iraq, due to appropriate the environmental conditions and the need to protect the fruit from sun leaflet blight disease in the summer (Al-Jamaily and Abu Al-Saad, 1989). The number of pomegranate trees is three million trees and are famous in Diyala, Karbala, Dahuk, Erbil and Sulaymaniyah cities, Iraq productivity of pomegranate 25 kg/tree (Al-Azi, 1990). Chemical fertilizers are essential for the nutrition of fruit trees, which are reflected in the productivity of these trees, nitrogen is the essential element of protein formation, which is mainly involved in the formation of protoplasm. It also enters the formation of amino acids, lecithin, chlorophyll, and plant hormones. Nitrogen increases the plant growth reflected positively on productivity (quantity and quality), and the lack of it leads to the weakness of its growth leaves (Abu dahi and Al-Yunis, 1988; Al-Taey and Majid, 2018). Nitrogen concentration is not stabilized in soil solution, As it changes according to changing seasons, temperature, microorganism and rains, where nitrates are susceptible to washing, accumulate in the upper layers during droughts, decrease their availability at low levels of moisture, nitrates are subjected to various transitions to ammonia and to nitrogen oxides that volatilize and lose to the atmosphere is a denitrification process (Abu dahiand al-Yunis, 1988). Boron is one of the necessary elements to the plant nutrition, and has received the attention of many researchers in proportion to the physiological importance of the plant, organic material is an essential source of boron, where boron releasing from organic matter. The plant takes advantage of part of it, while the other part is leaching from soil (Karamanos *et al*., 2003; Bal, 2005). Due to the low productivity of the tree of this crop, so we decided to choose our study for this research in this area to improve the vegetative growth and increase the productivity of pomegranate quantity and quality.

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Materials and Methods

The experiment was conducted from 1/3/2017 to 1/10/2017 in a private farm of Dokan district – Sulaymaniyah Province in northern to study the effect of soil fertilization at different levels of nitrogen and foliar nutrient at different levels of boron using Boric acid (17% B) on the growth, yield and its physical and chemical components of pomegranate. 54 trees were selected from pomegranate trees (Salimi) cultivated in (1986) and fairly homogeneous in size, growth rate and planted on lines, distance between tree and another 4 m and between line and another 4 m, The study included a factorial experiment with two factors. The first factor was soil fertilization with nitrogen before growing (Dormancy stage) at three levels (0, 10, 15 g / tree), The second factor was foliar fertilization by boron, with the two sprayings, the first one before the opening of buds and the second after the full flowers set, with three levels (0, 20, 40 g.L^{-1}). It was sprayed after prepared it on the total vegetative until the full wetting of the tree. Tween-20 was used with a concentration of 0.01%. The spraying was done early in the morning, The study parameters,

Leaf area (cm^2) : The leaf area was measured according to the Zainel method (2014).

1) **Leaves content of chlorophyll :** Chlorophyll was measured using Chlorophyll meter CCI-200 by Biber (2007).
2) **Percentage of flowers set :** After the full set, the number of fruits set was calculated according to the following law :

$$\text{Percentage of flowers set (\%)} = \frac{\text{Number of fruits set}}{\text{Total number of flowers}} \times 100$$

3) **Fruit weight :** was calculated according to the following equation:

$$\text{Average fruit weight per tree (g)} = \frac{\text{Total fruits weight of the six tress}}{\text{Total number of fruits of the six trees}}$$

4) **The yield of the single tree (kg) :** was calculated to the following equation:

$$\text{The yield of the single tree (kg)} = \frac{\text{Number of fruits remaining on the tree} \times \text{average of fruit weight}}{1000}$$

5) **Total soluble solids (TSS)% :** Percentage of total soluble solids in pomegranate grain juice was measured using Hand-Refractometer.
6) **Total acidity (TA)% :** Total acidity was calculated on the basis of citric acid is the predominant acid (gm /100 ml juice) as in the equation (Ranganna, 1986).
7) **Total acidity (TA)%** = [Base size x titrate (0.1) x Final size of juice x Equivalent weight (84) x 100) / (Volume of juice used in the Titration(10) × Volume of juice before dilution (10) × 1000]

Results and Discussion

Tables 1, 2, 3, 4, 5, 6, 7 indicates that the level of 15 g.L^{-1} of nitrogen was achieved significant differences among treatments in leaf area, chlorophyll content, fruit set %, fruit weight, yield, TSS% and TS%, compared with the control treatment while the boron application achived a significant differences leave area ,fruit weight and TS% compared to the control (tables 1, 4, 7). The beast overlap treatment between the nitrogen and boron achieved a significant differences in the most of the study parameters see tables , the treatment (15 g.L^{-1} of nitrogen and 40 mg.L^{-1} of boron) (table 1); the treatment (15 g.L^{-1} of nitrogen and 0 mg.L^{-1} of boron) (table 2), the treatment (15 g.L^{-1} of nitrogen and 40 mg.L^{-1} of boron) (table 3),

Table 1 : Effect of nitrogen and boron in leaf area (cm^2).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	3.58 e	4.31 cd	4.03 de	3.97 c
10	4.85 bc	4.36 cd	5.03 bc	4.75 b
15	5.25 ab	4.64 bcd	5.84 a	5.24 a
Average boron	4.56 b	4.44 b	4.96 a	Duncan test at 5%.

Table 2 : Effect of nitrogen and boron in chlorophyll content (CCI).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	110.00c	110.00c	117.50abc	113.00 b
10	119.00ab	118.67ab	112.00bc	116.56 ab
15	124.21a	112.17c	111.00c	119.81 a
Average boron	117.92a	116.50a	113.67a	Duncan test at 5%.

Table 3 : Effect of nitrogen and boron in fruit set (%).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	50.37 c	50.45 c	49.69 c	50.18 b
10	51.50 c	52.12 bc	50.63 c	51.44 b
15	52.07 bc	58.26 a	56.34 ab	55.56 a
Average boron	51.31 a	53.64 a	52.22 a	Duncan test at 5%.

Table 4 : Effect of nitrogen and boron in fruits weight (g).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	248.06bc	234.92c	249.62 b	244.23 b
10	255.92ab	246.21bc	249.54 bc	250.56 b
15	264.43a	255.35ab	259.97ab	259.92 a
Average boron	256.14a	245.45b	253.07a	Duncan test at 5%.

Table 5 : Effect of nitrogen and boron in the yield / tree (kg).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	25.50abc	25.25bc	25.32bc	25.34 b
10	26.06abc	27.82a	24.65c	26.17 ab
15	26.21abc	26.82abc	27.51ab	26.84 a
Average boron	25.98a	26.62a	25.83a	Duncan test at 5%.

Table 6 : Effect of nitrogen and boron in (TSS) (%).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	8.70d	9.87cd	10.33bcd	9.63 c
10	10.63bc	11.57abc	10.90bc	11.03 b
15	12.03ab	12.67a	12.97a	12.55 a
Average boron	10.45a	11.36a	11.40a	Duncan test at 5%.

Table 7 : Effect of nitrogen and boron in (TA) (%).

Nitrogen (g.L^{-1})	Boron (mg.L^{-1})			Average nitrogen
	0	20	40	
0	1.91a	2.03a	1.98a	1.97 a
10	1.61b	1.37b	0.98c	1.32 b
15	0.96c	0.93c	0.81c	0.90 c
Average boron	1.49a	1.45a	1.25b	Duncan test at 5%.

the treatment (15 g.L^{-1} of nitrogen and 0 mg.L^{-1} of boron) (table 4), the treatment (15 g.L^{-1} of nitrogen and 40 mg.L^{-1} of boron) (table 6), the treatment (15 g.L^{-1} of nitrogen and 0 mg.L^{-1} boron) (table 7), the effect of the results obtained in the using of nitrogen can be explained by the elevation of chlorophyll contents and leave area reflected positively to increases the photosynthesis and being a necessary component of most of the biological processes occurring within the plant as it contributes to increase the rate of cell division and its elongation ,the leaf area and produce a high led to increasing the carbohydrates and protein which manufactured nitrogen that stimulate plant (ALTaey *et al.*, 2017). The role of nitrogen to increase the leaf area reflected positively on the number of shoots and, total yield and total soluble solids (TSS). The effect of the results obtained when using of boron can be explained by the physiological processes such as photosynthesis, the movement and transfer of nutrients in the plant, as well as its effect on cell division and its elongation, which increased plant growth, boron directly increase flowering set by stimulating a number of enzymes that have a direct role in flowering set (Abu Dahi and Al-Yunis, 1988.), as well as the effective role of boron in the synthesis and metabolism of proteins and amino acids, which have a direct and indirect role in fruit development.

Conclusion

The results showed that nitrogen and boron applications led to a significant increase, leaf area, chlorophyll content, fruit set, fruit weight, total soluble solids (TSS) and total acidity (TA).

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