The effect of organic fertilizer and spraying with boron on the vegetative characteristics of potato plants (Solanum tuberosum L.)

Maysoon M Kadim[1*], Kawther Abdul Latif Abadi[2]

Abstract

The field experiment was carried out at the Agricultural Research Station of the College of Agriculture - University of Sight during the 2020-2021 agricultural season to study the impact of manure addition and boron spraying on potato growth and yield. (R.C.B.D.) With three repeats as a two-factor working experiment in which the first agent overlaps manure at four levels (0,8,16,32) tons .ha-1 and second factor is boron spraying with four levels (0,25 ,50,75) mg.l-1, The arithmetic averages of the coefficients were compared under the L.S.D Least Moral Difference Test, at a moral level of 0.05. The results showed that all levels of manure (16 ,32) led to a moral increase in all indicators of study: plant height, number of leaves, number of main legs, paper area, wet and dry weight of vegetable total, while boron spraying with (50 ,75) led to a moral increase in plant height, number of leaves, paper area, wet and dry weight of vegetable total.

Key Words: Manure, boron, main stalk

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Introduction

potatoes. (Solanum tuberosum L) is one of the most important green crops in the world, which follows the eggplant family Solanaceae and ranks fourth globally after wheat, maize and rice in terms of nutritional importance (Fadoli, 2011).They are of high nutritional value for carbohydrates, vitamins, certain nutrients and mineral salts, as well as economically profitable crops (FAO, 2008). The area of potato grown in Iraq, but the quantities produced still fall short of the Iraqi consumer's need. To improve the reality of potato crop cultivation in Iraq, attention must be paid to various agricultural service operations, including saving the necessary nutrients needed by plants. They play an important role in the growth and production of the plant because they participate in or assist in the metabolic processes of the plant and perform important functions, and their deficiency as a result of the lack of dietary balance that may occur in physiology causes disruption due to soil environment conditions and composting methods (Aziz et al,2020). Many researchers have been interested in studying the effects of organic fertilizers on plant growth and yield. Organic matter is an important and effective factor in influencing the readiness of plant nutrients because of its characteristics that affect the soil content of soil nutrients and make it ready for absorption by the plant and thus positively affect plant growth and development (kadim et al,2020). The addition of organic residues to the soil increases the organic matter and the numbers and activity of microbial, as well as the continuous addition of soil diets, thus rebalancing their nutrients. Organic additives are thus a good source of nutrients for plant processing as well as for reducing loss through washing, by being adsorbed on their minute surfaces (Rasheed et al ,2017) and their presence in accumulations that are less than the plant's need leads to poor plant growth, so it is necessary to meet the plant's needs for the elements. The paper is a food-processing centre, so the lack of nutrients is evident on the leaves, and it must be urgently addressed by paper feeding (Bryan, 1999).

Corresponding author: Maysoon M Kadim
Address: [1,2]Horticulture and garden design dept., College of Agriculture, University of Basrah, Iraq

E-mail: maymo6245@gmail.com

The plant requires nineteen essential food elements for growth and development that directly enter into the formation of one or more of the mission compounds and contribute to metabolic processes or perform other important functions (Ugwuanyi et al , 2016). Boron is an important micro-nutrient in the growth and evolution of the plant by facilitating the movement and transmission of photosynthetic products from the leaves to the effective regions of the plant. It also plays an encouraging role in pollen plants and the growth of the pollen tube and in increasing fertilization and conserving the hydrophobic balance of the cell (AL-Waeli ,2018) because of the paucity of studies on the use of organic composting and boron spraying on potato plants, this study was conducted.

Materials and methods

The field experiment was carried out at the Agricultural Research Station of the Faculty of Agriculture/University of Basra/Karma Ali, located at a longitude of = 30 ° 34.7-25 N and latitude of = 47 ° 45.9-91 W for the autumn season 2020-2021.(0-30) poison, mixed well, dried under the sun's rays, and sieving passed through 2 mm, sampled irrigation water and carried out chemical and physical analyses of these samples in the Central Laboratory/All Agriculture/Sight Probe. Table 1 shows some of their chemical and physical qualities. The manure (cow residue) was collected and prepared from the fields of the Agricultural Research Station of the Faculty of Agriculture/University of Basra and then placed in Conkrette basins with dimensions of 3 x 6 m (length x width) at a height of 5.1 m lined with polyethylene to prevent the salt effect and placed with the residues (primary bacterial) 10 kg. Dunum uria (Shibani, 2005) was then hydrated to saturation and then covered in plastic for the purpose of encouraging anaerobic reactions, reducing nitrogen loss during the degradation process, also accelerating the degradation process. The residues fluctuated every two weeks for the purpose of dendritic homogeneity., The incubation process lasted for 3 months according to (Aziz et al,2020) ., Table , (2) showing some chemical traits of organic residues after degradation. The soil of the field was made from tillage, sculpture and levelling, and then the experiment was divided into sectors of each sector. It was divided into panels, where agriculture was carried out on the basis and length of each 3 m marz and the distance between Mz and the last half m, leaving a distance of 1 m between the panels and 2 m between the sectors, for the purpose of preventing the transmission of the masters between the trails and the distance between Jur and 30 cm and there were 20 potato tubers in the pilot unit, the field was sheltered by drip irrigation, and the irrigation system was distributed in proportion to the potato crop requirements. the number of plants. Agricultural service operations have also been carried out in a similar manner to all plates of herbivores and exports of disease and insect control (Waseem et al ., 2008). The seeds of the Burren class were obtained from the Orad Day Trade Company for potatoes and agricultural inputs. Ten days before planting, the seeds are extracted and left in a misguided place to get rid of excess moisture, to stimulate them to plant, then to sort and exclude the infected and mechanically damaged derns and to consolidate their appropriate weights to the limits of.(50-60) Gum (Matlob et al., 1989). Before cultivation, derns were covered with a fungicide. (Rhizolyx 50) With a concentration of 300 g/100 to irrigate against fungal disease, whole derns were grown in the autumn cranium on 13/10/2020 in the upper third of the marz and on the side and 10 cm deep (Al thubaibe and Al sahaf , 2010). The experiment involved studying the effect of two factors with three repeats: four levels of decomposing cow fertilizer (0.8,16,32 tons .ha-1) and was added before cultivation, infestation on soil. The second factor, boron spraying, was four levels (0.25,50,75 mg/L), where it was sprayed on the vegetable total twice during the growing season after 7 and 9 weeks of cultivation. Implemented as a working experiment using dissociative block matriculation in the design of full randomized sectors (R.C.B.D.) randomized complex block design with three repeats for workers. The calculation metrics were compared using the Least Moral Difference Test (L.S.D.) at 0.05 probability level using the Gen stat analysis program. Field readings were taken from five randomly selected plants from each pilot unit at the maturity stage of the derns and the following indicators were recorded:

Table (1) Some physical and chemical properties of soil and irrigation water for the growing season 2020-2021

Type of analysis	measruing unit	the value	Source
EC	ds.m-1	5.12	Page et al(1982)
pH	-	8.00	
Total nitrogen	g.kg-1	2.75.	
Ready phosphorous	g.kg-1	1.43	
Ready Potassium	g.kg-1	2.34	
Organic matter	%	0.63	
The proportion of clay	%	45.90	Black,1965
Silt ratio	%	43.60	
Sand ratio	%	10.50	
Soil tissue	-	Silty clay	
Fe	ppm	8.276	
Irrigation water characteristics			
EC	ds.m-1	2.5	Page et al(1982)
pH	-	7.3	
Fe	ppm	0.173	

1-Plant height (cm) :The height of the plant from its focal point to the developing summit was measured by a metric tape, after which the rate was extracted for the selected five plants.

2- Number of papers: The number of leaves for each of the five selected plants in each trial alone was calculated and the rate taken.

3- - Number of main stems (stem.plant-1)The number of aerial stems was calculated from the bottom of the soil surface for five selected plants and the average was calculated.

4- Paper area (Dcm2) : 30 tablets of known space were taken for five plants, and then dried in an electric furnace (Oven) at 70 m, until the weight was constant, and then by the dry weight of the leaves of the plant, the paper area was calculated by the formula.

Leaf area (dm2) = The leaf area of the leaves is 2 cm x the dry weight of the leaves of the plant/ Dry weight of tablets (gm) x 100

Table (2) Some chemical properties of organic fertilizers

Adjective	Unit of measurement	after fermentation
PH		8.2
EC	ds/m	34.3
Organic Carbon	g/kg	230.6
N	g/kg	12
P	g/kg	3.65
K	g/kg	5.01
Organic matter	%	150.4

Results and discussion

- The effect of organic fertilizer and spraying with boron and the interaction between them on plant height.

Average effect of organic fertilizer	effect of boron(ml L-1)				anic fertilizer (T/ha-1)
	75	50	25	0	
43.75	47.70	43.62	43.47	40.22	comparison treatment
51.52	46.81	47.40	58.81	53.06	8
56.95	66.03	59.74	52.07	49.96	16
77.70	83.32	79.51	76.95	71.03	32
	60.96	57.57	57.82	53.57	average effect of boron
overlap	boron		organic fertilizer		L.S.D(0.05)
5.22	2.77		2.59		

Table (3) the effect of organic fertilizer and boron treatments and the interaction between them on plant height (cm)

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Average	effect of boron(ml L-1)	effect of

Table and (3) explain that the factor of organic fertilizer has a significant effect on plant height, especially plants fertilized at the level of 32 tons ha-1, which showed a significant increase compared to the comparison and other fertilizer treatments, with an increase rate of (77.6, 36.44, 50.82)%, respectively (comparison, 16 tons) (ha-1,8 ton ha-1), and all other fertilizer treatments showed a significant increase compared to the comparison. The table also shows that the boron spray factor had a significant effect on plant height, especially plants treated at the level of 75 mg L-1, which showed a significant increase compared to the comparison other fertilizer treatments, with an increase rate of (13.79, 5.43, 5.89)%, respectively (the comparison, 25 mg L- 1, 50 mg L-1) and there are no significant differences between the second and third levels. As for the interaction between the two factors of the study, it was significant, as the treatment gave 32 tons ha-1 + 75 mg L-1) the highest height of the plant, reaching (83.32 cm) compared to The lowest height was (40.22 cm) in the effect of boron with the comparison treatment.

1- The effect of organic fertilizer and spraying with boron and the interaction between them on on number of leaves (leaf/plant-1).

Table (4) the effect of organic fertilizer and boron treatments and the interaction between them on number of leaves (leaf/plant-1)

	75	50	25	0	
21.03	22.80	21.35	20.70	19.30	comparison treatment
25.29	26.76	25.78	24.68	23.92	8
28.25	30.22	26.53	28.28	27.98	16
27.03	29.54	24.94	28.30	25.32	32
	27.33	24.65	25.49	24.13	average effect of boron
overlap	boron		organic fertilizer		L.S.D(0.05)
N.S	1.74		3.39		effect of

Average effect of organic fertilizer	effect of boron(ml L-1) 75	50	25	0	organic fertilizer (T/ha-1)
2.80	2.99	2.77	2.68	2.75	comparison treatment

compared to the control treatment and other fertilizer treatments with an increase rate of (34.33, 4.51, 11.70) respectively. The comparison, at level 32, at level 8), and there are no significant differences between the other averages, and the same table shows that the boron spray factor had a significant effect on the number of leaves per plant if the concentration was given 75 mg L-1 the highest number of leaves with an increase of (13.26%) And there are no significant differences between the second and third levels. As for the interaction between the two study factors, it was not significant.

Table (4) shows that the factor of organic fertilizer has a significant effect on the number of leaves per plant, especially plants fertilized at the level of (16 tons ha-1), which showed a significant increase

3- The effect of organic fertilizer and spraying with boron and the interaction between them on The number of main stems.

Table (5) the effect of organic fertilizer and boron treatments and the interaction between them on The number of main stems.

3.53	3.51	3.68	3.52	3.41	8
3.73	4.31	3.26	3.64	3.71	16
4.64	4.77	4.70	4.69	4.39	32
3.89	3.60	3.63	3.56		average effect of organic fertilizer (T/ha-1)
overlap	boron		organic fertilizer		L.S.D(0.05)
23.91	22.99	25.72	25.13	21.81	comparison treatment
0.54	N.S		0.40		
26.58	30.39	25.84	26.14	23.94	8

Average effect of boron (ml L-1) 75 50 25 0 Average effect of organic fertilizer

Table (5) shows that the factor of organic fertilizer has a significant effect on the characteristics of the number of main stems of the plant, especially the plants that were fertilized at a level of 32 tons ha-1, which showed a significant increase compared to the control treatment and other fertilizer treatments, with an increase rate of (65.71, 24.39, 31.44)% on respectively (the comparison, the level of 16 tons ha-1, the level of 8 tons ha-1), and there are no significant differences between the second and third levels, as shown in the table that the spraying agent with boron had a non-significant effect on the number of main stems on the plant, as for the interaction between the two factors it was significant The treatment 32 tons ha-1 + 75 mg L-1 gave the highest number of main stems of 4.77 plant stems-1) compared to the lowest number of main stems sprinkled with boron amounted to 2075 plant stems-1 with the comparison treatment

4- The effect of organic fertilizer and spraying with boron and the interaction between them on Leaf area of the plant (dm2).

Table (6) the effect of organic fertilizer and boron treatments and the interaction between them on Leaf area of the plant (dm2)

36.70	38.21	38.67	36.39	33.51	16
41.47	44.58	41.39	40.84	39.07	32
	34.04	32.91	32.13	29.58	average effect of boron
overlap	boron		organic fertilizer		L.S.D(0.05)
2.69	1.43		1.32		

Table (6) shows that the factor of organic fertilizer has a significant effect on the leaf area of plants, especially the fertilized plants at the level of (32 tons ha-1), which showed a significant increase compared to the control treatment and other fertilizer treatments, with an increase rate of (73.44, 12.99, 56.02)%, respectively. The comparison, the level of 16 tons ha-1, the level of 8 tons ha-1) and all other fertilizer treatments showed a significant increase compared to the control treatment, and the same table shows that the spraying agent with boron had a significant effect on the leaf area of the plant, where the fertilized plants showed a level of 75 mg L 1- A significant increase compared to the control treatment and the other fertilizer treatments (15.07, 3.43, 5.94) %, respectively (the control and the level of 50 mg L-1, and the level of 25 mg L-1), , As for the interaction between the two factors of the study, it was significant, as the level (32 tons ha-1 + 75 mg L-1) gave an increase of (44.58 dm 2) for the leaf area of potato plant compared to the lowest leaf area in the boron spray treatment that amounted to 21.81 dm 2 with comparison treatment.

5- The effect of organic fertilizer and spraying with boron and the interaction between them on fresh weight of the vegetative total of the plant

Table 7- The effect of organic fertilizer and spraying with boron and the interaction between them on fresh weight of the vegetative total of the plant

Average effect of organic fertilizer	effect of boron(ml L-1)				effect of organic fertilizer (T/ha-1)
	75	50	25	0	
74.44	75.54	76.58	75.23	70.43	comparison treatment
	82.65	81.02	80.12	77.72	8
	81.99	81.35	81.88	83.40	16
	88.31	86.36	85.55	82.68	32
	82.12	81.33	80.69	78.56	average effect of boron
overlap	boron		organic fertilizer		L.S.D(0.05)
N.S	2.11		3.87		

Table (7) shows that the organic fertilizer factor was significant in the fresh weight of the vegetative total of the plant, especially the fertilized plants at the level of 32 tons hectare-1, which showed a significant increase compared to the comparison treatment and other fertilizer treatments with an increase rate of (15.17, 4.36, 6.66) %, respectively. The comparison, 16 tons ha-1,8 tons ha-1) As the same table shows, there are no significant differences between the second and third levels, and the same table shows that the spraying agent with boron had a significant effect on the fresh weight of the plant, especially the plants fertilized at a level of 75 mg L- 1 It showed a significant increase compared to the comparison and other fertilizer treatments, with an increase rate of (4.53, 0.97, 1.77)%, respectively, and there are no significant differences between the other averages. As for the interaction between the study factors, it was not significant.

6- The effect of organic fertilizer and spraying with boron and the interaction between them on dry weight of the vegetative total of the plant

Table 7- 5- The effect of organic fertilizer and spraying with boron and the interaction between them on the dry weight of the vegetative total of the plant.

Average effect of organic fertilizer	effect of boron(ml L-1)				effect of organic fertilizer (T/ha-1)
	75	50	25	0	
27.00	30.58	29.84	26.77	20.80	comparison treatment
34.92	36.45	37.18	33.28	32.80	8
31.93	32.87	29.87	32.01	32.95	16
34.28	34.80	35.69	32.68	33.95	32
	33.67	33.14	31.18	30.12	average effect of boron
overlap	boron		organic fertilizer		L.S.D(0.05)
3.97	1.91		2.65		

Table (8) shows that the factor of organic fertilizer has a significant effect on the dry weight of the vegetative total of the plant, especially plants fertilized at the level of 8 tons ha-1, where it showed a significant increase compared to the comparison and other fertilizer treatments, with an increase rate of (28.66, 0.78, 8.80)%, respectively (compared to There are no significant differences between the second and third levels. The table shows that the spraying agent with boron had a significant effect on the dry weight of the vegetative total of the plant, especially the plants treated at the level of 75 mg L-1, where it showed an increase Significant compared to the comparison and other fertilizer treatments, with an increase of (12.38, 2.70, 8.56)%, respectively (the comparison, 50 mg L-1, 25 mg L-1) and there are no significant differences between the other levels. As for the interaction between the two factors of the study, it was significant, as the treatment gave 8 tons ha-1 + 75 mg L-1) an increase of (37.18 g) compared to the lowest dry weight of the vegetative total of the plant amounted to (20.80 g) with the control treatment.

We note from the results of the previous tables (3,4,5,6,7,8) that the factor of organic fertilizer has a significant effect on plant height, number of leaves, number of main stems, leaf area, wet and dry weight of the vegetative total and this is due to the positive role of fertilizers The organic matter that was added to the soil, which led to an increase in nitrogen and phosphorous rates in large proportions, which in turn enters the composition of nucleic acids, DNA, RNA and protein, and the increase of these elements leads to cell division and an increase in the mass of protoplasm Thus, the volume of vegetative growth increases, represented by the height of the plant (Al-Sahhaf et al., 2011), as well as the organic fertilizers increase the vegetative growth and plant height by improving the fertile and physical properties of the soil and thus lead to the readiness of the major and minor elements important in vital processes (Al-Obaidi, 2008), And also, nitrogen has an important role to increase the stimulation of cell division and elongation as a result of the increase in the content of cytokinin and gibberellin concentration in the leaves, which leads to an increase in the number of leaves, leaf area and number of branches and this is reflected in the wet and dry weight of the vegetative group, and organic fertilizers have a role in increasing plant growth because of the acid they contain (Volvic and Humic) containing organic acids that enter the formation of proteins Which are often ready for absorption by the plant (Al-Shater and Al-Bakhli, 2010) and organic fertilizers have a role in respiration and carbon metabolism, as well as working to provide the necessary energy to build new cells, which increases plant growth (Taiz and Zeiger, 2006) and thus increase the number of leaves. Also, the decomposition of organic fertilizers leads to the production of nitrogen and phosphate compounds that encourage the buds dormant on the surface of the tuber to grow, increasing the number of stems (Al-Sahhaf and Aati, 2007). Also, the role of organic fertilizers in the accumulation of materials manufactured by the photosynthesis process such as proteins and carbohydrates in the plant tissues, which caused an increase in the leaf area of the plant, which In turn, it leads to an increase in the dry matter percentage of the vegetative system (Othman, 2007). This is consistent with the results of Al-Salmani and Al-Bandawy (2014) on the potato plant. The results of tables (3,4,5,6,7,8) also show that the boron spray factor has a significant effect on plant height, number of leaves, leaf area, wet and dry weight of the vegetative total. The reason may be due to the role of boron in building a strong root system with a high efficiency in absorbing macro and micro nutrients and increasing their concentration within the plant (Aydn and Sevine, 2006), as well as boron's role in improving biochemical and physiological processes and during the activation of meristematic tissues, increasing cell division and elongation, and increasing production and the effectiveness of growth regulators, which is reflected positively on vegetative indicators and their increase (Ali et al., 2014).This is consistent with the results of Al-Shammari (2018).

Conclusions and Recommendations

Conclusions

It is concluded from the experience that the addition of organic fertilizer led to an increase in the vegetative growth characteristics of potato plants

It is also concluded from the experience that spraying with boron improved the vegetative growth characteristics of potato plants

Recommendations

It is recommended to adopt levels 16 and 32 of organic fertilizer when planting potatoes, in order to improve the vegetative growth characteristics.
50 and 75 ml / liter for the positive cycle in improving the vegetative growth characteristics of potato plants
3- It is recommended to adopt other sources of organic fertilizers and on other plants with different compositions. It is also recommended to spray with fertilizers of micro-elements other than boron.

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