



Research Article

**EFFECT OF OPTIMUS PLUS NANO-ORGANIC FERTILIZER SPRAYING
ON THE GROWTH AND YIELD OF TWO CULTIVARS OF ROSELLE
Hibiscus sabdariffa L.**

Bader Hilal Mahdi Abdul Karim Hussein Romi*

Abstract

A field experiment was conducted in the fields of a farmer in Al- Musaib project area (15 km north of Hilla) during the spring season of 2022 to investigate the effect of different levels of seaweed extract on the growth and yield of two cultivars of Roselle. The experiment was conducted according to the Randomized Complete Block Design (RCBD) in the order of factors and with three replicates. As for the second factor: three concentrations of nano-organic fertilizer (0, 1 and 2 ml/liter). The results showed the following: The eggplant cultivar excelled for all studied (leaf area, chlorophyll content, number of nuts per plant, number of seeds per nut, and vitamin C content), giving the highest mean for the (81.36 cm², 44.07 spad, 86.02 nut plant⁻¹ nuts, 30.18 nut seeds⁻¹ and 71.94 mg L⁻¹), respectively. Concentration p2 (the third level of organic fertilization) was superior by giving it the highest average of the above-studied (92.90 cm², 47.08 spads, 195.69 nut plant⁻¹, 33.54 nut seeds⁻¹, 76.86 mg L⁻¹), respectively. As for the bi-interaction between cultivars and nano-organic fertilizer, the combination (V1 X P2) gave the highest mean for the studied (108.39 cm², 51.80 spads, 270.49 nuts, 38.29 nut seeds⁻¹ and 91.45 mg L⁻¹), respectively.

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1. Introduction

Roselle *Hibiscus sabdariffa* L. is an important medicinal plant and its cultivation is concentrated in India, Australia, Africa, Indonesia, Egypt, Sudan, and Iraq (Mohsen, 2019). Its sepal leaves contain active substances such as malic, citric, and protocatechonic acid, which has a superior ability to scavenge free radicals and thus a treatment for cancerous diseases (Killic *et al.*, 2011). It also contains vitamin C, which raises the body's immunity by making the medium acidic (pH = 3.5) and thus does not allow the growth of bacteria, fungi, and viruses.

It is also rich in flavonoids and phenols, which are pigments, the most important and most effective of which is anthocyanin, which is a medicinal substance as that is anti-inflammatory. To oxidation, improve vision, calm inflammation, and protect the walls of blood vessels from high pressure (Louis, 2013). Roselle plant is often infected with the red spider, and this would reduce the efficiency of the photosynthesis process of the plant and reduce seed production and sepals leaves. When planting is delayed, the harmful effect of the insect decreases. In addition, nano-organic fertilizers, due to the accuracy of their size, enter the plant tissues and encourage them to

*Corresponding author. Bader Hilal Mahdi Abdul Karim Hussein Romi

absorb nutrients in an easy manner. Therefore, the plant fully absorbs what it needs of water and nutrients, and thus we get greater vegetative and fruitful growth. In addition to the role of nano-organic fertilizers in increasing the percentage of absorbed nitrogen, and this in turn increases the chlorophyll content, improves soil properties, increases the speed of growth, and increases production (Al-Kuraiti, 2021). The study aimed to:

- Determine the best cultivar in terms of vegetative, fruiting and qualitative growth.
- Determine the best concentration of nano-organic fertilizer to obtain better growth, production and quality.
- Determine the best bilateral overlap between workers to obtain higher production.

2. Materials and Methods

Experiment location

A field experiment was conducted in the village of Abu Al-Jasem (PBUH) (30 km north of

the center of Babylon province) in 2022 according to the RCBD, in the order of factors to equal the importance of the experiment factors, and with three replicates. The first factor is two cultivars of the Roselle plant, which are eggplant and red, and their symbol is V1, and V2, respectively. The second factor is the organic nano-fertilizer Optimus Plus with three levels (0, 1, 2) ml/liter and its symbol (P0, P1, P2), respectively (Table - 2).

Soil testing

Several samples of field soil were randomly taken from different places, cleaned, mixed with some, air-dried, and completely homogenized, then a laboratory test sample was taken from it in order to study some of its chemical and physical properties according to the method of Page *et al.* (2000) and this was done in the laboratories of the Soil Department in the College of Agriculture, Al-Qasim Green University (Table - 1).

Table – 1: Some chemical and physical properties of the experimental soil

Traits	Units	Values
Electrical conductivity (EC)	DS.m ⁻²	3.12
pH	---	8.20
Organic matter	g.kg ⁻¹	19.22
Nitrogen	mg.kg ⁻¹	12.50
Phosphorous	mg.kg ⁻¹	18.67
Potassium	mg.kg ⁻¹	66.22
Clay	g.kg ⁻¹	492
Sand	g.kg ⁻¹	360
Silt	g.kg ⁻¹	148
Soil texture	Silty clay	

Table (2) Components of Optimus Plus nano-organic fertilizer

Components	Percentage
Natural organic materials	50 %
Free binary amino acids	29 %
Organic carbon	20 %
Nitrogen	1 %
pH	From 5 to 8

Studied Traits

The following were studied:

- Leaf area (cm²)
- Chlorophyll content (Spad)
- Number of nuts per plant (nut. plant⁻¹)
- The number of seeds per nut (nut seed⁻¹).
- Vitamin C content of sepal leaves (mg L⁻¹)

Statistical analysis

The studied data were analyzed according to the design used statistically, and the arithmetic means of the coefficients were compared using the least significant difference test (L.S.D) at a probability level of 0.05 (Al-Rawi and Khalafallah, 1980).

3. Results and Discussion

Leaf area (cm²)

The Table - 3 shows the effect of different levels of nano-organic fertilizer on the leaf area trait of Roselle plant. It was found that the V1 (aubergine) cultivar excelled on the second V2 (red) cultivar, giving the highest average of 81.36 cm² for the, while the red cultivar (V2) gave the lowest average for the amount to 62.55 cm², and an increase in the average grade of 23.11 % was achieved. From the same table, concentration P2 excelled on the nano-organic fertilization, giving the highest mean for the amounted to 92.90 cm², while concentration P0 gave the lowest mean for the studied amounted to 53.53 cm², and an increase in the amounted to 42.37 %. As for the bi- interaction between the two experimental factors (cultivars and organic nano-fertilizer), the combination (V1 X P2) excelled by giving it the highest mean for the leaf area trait of 108.39 cm², while the combination (V2 X P0) gave the lowest average for the amounting to 46.92 cm², thus achieving an increase in the amounted to 56.71 %. The results agreed with what was reached by Hassoun *et al.* (2017), where a discrepancy was found in the leaf area of the cultivars, where it was found that the white cultivar excelled on the other two cultivars, red and striped, in order. it also supported the results (Al-Kuraiti, 2021), where he found significant differences between the levels of

nano-organic fertilizer for the studied, explaining the reason to the components contained in the nano-organic fertilizer of organic and mineral nitrogen and amino acids, in addition to the sufficient availability of nitrogen in the plant, which leads to an increase in The content of chlorophyll in the leaves, thus increasing the efficiency of the carbon metabolism process and increasing the formation of the reducing agent NADPH, which is necessary for the CO₂ reduction process and its entry into the manufacture of organic compounds, and the latter helps in the activity of plant growth, including the leafy area (Al-Akaishy, 2020).

Chlorophyll content (SPAD)

The Table - 4 shows the effect of spraying the organic nano-fertilizer. Optimus plus on the trait of chlorophyll content in the Roselle plant. It was found that the Eggplant cultivar (V1) excelled, where it gave the highest average for the amounted to 44.07 spade, while the red cultivar (V2) gave the lowest average for the, amounting to 38.00 spade, and an increase occurred. in trait amounted to 13.77 %. As for the organic nano-fertilizer, the p2 level excelled by giving it the highest mean for the amounting to 47.08 SPAD, while treatment P0 (control treatment) gave the lowest mean for the amounting to 35.47 SPAD, and for this an increase in the amounted to 24.66 %. As for the interaction between the two factors of the experiment, which are the cultivars and the organic nano-fertilizer, the combination (V1 X P2) excelled by giving it the highest average of 51.80 spad for the, while the combination (V2 X P0) gave the lowest average of 36.76 spad for the, and it achieved an increase in the amounted to 29.03 %. The results were supported by Al-Amin (2018) and Amin *et al.* (2020), explaining the reason for the increase in the between cultivars as a result of a difference in its genotype and the readiness of each genotype to excel in a biological work in which the other fails. As for the addition of nano-organic fertilizer, their effect differs on the studied trait, and this is due to the components of this fertilizer, especially nitrogen, which is an essential element in building amino acids in plant tissues.

Nitrogen is the first step in building protein, and amino acids are important and essential substances in the growth and development of plant tissues, especially leaf tissues and their components, the

most prominent of which is chlorophyll, since nitrogen is an essential component of the chlorophyll molecule, which gives the green color to plants.

Table – 3: The effect of adding nano-organic fertilizer on the leaf area traits of two cultivars of Roselle

Organic fertilization Cultivars	P0	P1	P2	Average cultivars
Eggplant V1	60.15	75.54	108.39	81.36
Red V2	46.92	63.31	77.42	62.55
Average organic fertilization	53.53	69.42	92.90	
LSD				

Table (4) Effect of adding nano-organic fertilizer on two cultivars of Roselle

Organic fertilization Cultivars	P0	P1	P2	Average cultivars
Eggplant V1	36.67	43.66	51.80	44.07
Red V2	43.19	37.45	42.37	38.00
Average organic fertilization	35.47	40.55	47.08	
LSD				

Number of Nuts per Plant (Nut. plant⁻¹)

From Table - 5, it is clear that the eggplant cultivar (V1) was excelled on the red cultivar (V2) of the Roselle plant for the number of nuts per plant, giving the highest average of 165.55 nuts per plant, while the red cultivar (V2) gave the lowest average of 86.02 nuts for the trait. There was an increase in the trait between the two classes amounted to 48.03 %. As for the effect of adding different levels of organic nano-fertilizer on trait of the number of nuts per plant, the concentration P2 was excelled on the rest of the levels, giving the highest mean for the trait amounted to 195.69 nuts. plant⁻¹, while the control treatment gave the lowest averages for the trait amounted to 65.24 nuts.plant⁻¹. An increase in trait amounted to 66.66 %. As for the bi-interaction between the two experimental workers, the combination (V1 X P2) excelled by giving it the

highest average of 270.49 nuts nuts. plant⁻¹ (V2 X P0) The lowest averages for the trait for the studied amounted to 50.26 nuts.plant⁻¹ and thus there was an increase between the two combinations of 81.41 %. The difference in the trait is due to the different genotypes due to their differences in physiological processes and the speed of its reception of the nano-organic granulator. In addition, the nano-organic fertilizer has an important role in increasing the foliar filtration and then increasing the photosynthesis and the accumulation of dry matter (Alawi, 2011). And that nitrogen has an important role in increasing the yield components, including the number of nuts in the plant (Al-kaaby and Al-zurfi, 2016), and the study was also supported.

Number of seeds in a nut (Seed nut⁻¹)

The Table - 6 shows the effect of spraying the organic nano-fertilizer Optimud plus on two cultivars of Roselle on the number of seeds per nut. It was found that the cultivar V1 (Eggplant) excelled for the studied trait over the red cultivar (V2), giving the highest average of 30.18 seed nut⁻¹ seeds for the studied trait, while the V2 (red) cultivar gave the lowest mean for the trait, amounting to 24.42 seed nut⁻¹. Thus, there was an increase in the trait between the two traits, amounting to 19.08 %. This difference is due to their differences in the genetic makeup of both cultivars, which is reflected in its vital activity. As for the organic nano-fertilizer, the P2 level excelled by giving it the highest mean for the studied trait amounting to 33.54 seed nut⁻¹, while the P0 level gave the lowest average for the trait amounting to 21.78 seed nut⁻¹, so there were differences between the two levels amounted to 35.06 %. As for the bi-interaction between the

experimental factors (cultivars and biofertilizer), the combination (V1 X P2) excelled, giving the highest averages for the trait amounting to 38.29 seed nut⁻¹, while the combination (V2 X P0) gave the lowest averages for the trait amounting to 20.09 seed nut⁻¹. There was an increase in the trait amounted to 47.53 %. The results agreed with what was reached by Atta *et al.* (2001), Ottai *et al.* (2006) and Matar (2010) who confirmed the role of nano-organic fertilizer in increasing the root system that absorbs nutrients and nutrients from the soil and leaves with high efficiency, and thus increases the efficiency of the photosynthesis process. This was supported by Al-Badiri (2001), pointing out that "nitrogen is one of the most important components of the organic nano-fertilizer, which gives the best vegetative growth and then encourages the growth of flowers and stimulates the processes of pollination, fertilization, and the formation of fruits and seeds.

Table – 5: Effect of spraying organic nano-fertilizer on two cultivars of Roselle on the number of nuts per plant (nuts. plant⁻¹)

Organic fertilization Cultivars	P0	P1	P2	Average cultivars
Eggplant V1	80.22	145.96	270.49	165.55
Red V2	50.26	86.92	120.89	86.02
Average fertilizer organic	65.24	116.44	195.69	
LSD				

Table – 6: Effect of spraying bio-organic fertilizer on the number of seeds per nut of two cultivars of Roselle

Fertilizer organic Cultivars	P0	P1	P2	Average cultivars
Eggplant V1	23.47	28.78	38.29	30.18
Red V2	20.09	24.40	28.79	24.42
Average fertilizer organic	21.78	26.59	33.54	
LSD				

Vitamin C content

The Table - 7 shows the effect of spraying organic nano-fertilizer on trait of the percentage of vitamin C in the leaves of the sepals of the Gujarat. It became clear that the V1 cultivar (Eggplant) was excelled on the red cultivar V1, giving the highest average of the trait amounted to 71.94 mg L⁻¹, while the red cultivar gave the lowest averages of 71.94 mg L⁻¹. 52.75 mg L⁻¹, and an increase in the grade amounted to 26.67 %. As for the spraying of the organic nano-fertilizer, the concentration P2 was superior in it, giving the highest mean for the studied trait amounted to 76.86 mg L⁻¹, while the control treatment gave the lowest average for the trait amounted to 47.70 mg L⁻¹, and thus an increase in the trait amounted to

37.93 %. As for the bi-interaction between the two experimental workers, the combination (V1 X P2) excelled by giving it the highest average for the trait amounted to 91.45 mg L⁻¹, while the combination (2 V X P0) gave the lowest average for the studied trait amounting to 44.66 mg L⁻¹, and thus an increase in the trait amounted to 51.16 %. The reason for the increase in the content of vitamin C may be attributed to the effective role of nitrogen in raising the efficiency of the photosynthesis process, thus increasing the efficiency of manufacturing more sugars and amino acids and some secondary compounds such as vitamin C in the sepals of the Roselle plant (Tisdal, 1997).

Table – 6: Effect of spraying bio-organic fertilizer on the number of seeds per nut of two cultivars of Roselle

Fertilizer organic Cultivars	P0	P1	P2	Average cultivars
Eggplant V1	50.73	73.64	91.45	71.94
Red V2	44.66	51.32	62.27	52.75
Average organic fertilization	47.70	62.48	76.86	
LSD				

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