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The Impact Of Traditional And Nano Calcium Fertilizer And Nitrogen On Chemical Characteristics In Cucumber Plant

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Abstract

The experiment was carried out in one of the unheated greenhouses located in Al-Haidariya sub-district of Najaf governorate during the fall season 2019. The effect of spraying calcium fertilizer (Nano- and conventional) and nitrogen on the growth, yield and chemical characteristics of two varieties of cucumber, a factorial experiment was conducted using the Randomized Complete Block Design (RCBD) with two factors, the first factor is foliar fertilization. The second factor was the cultivar factor, namely, the Yekta and the cultivar Maimon cultivar. The comparison was made between the averages of treatments according to Duncan's test and under the probability level of 0.05. Each treatment was repeated three times, and the results indicated the following:

The plants of the Yekta cultivar (V1) were significantly superior in all indicators of vegetative growth, yield characteristics and components studied, relative chlorophyll content in leaves (42.92 SPAD) , total nitrogen content in leaves (31.20 mg kg^{-1} dry weight), total phosphorous content in leaves (3.97 mg kg^{-1} dry weight) , total potassium content in leaves (25.73 mg kg^{-1} dry weight), total calcium content in leaves (3.87 mg kg^{-1} dry weight), total nitrogen content in fruits (19.83 mg kg^{-1} dry weight), total phosphorous content in fruits(2.73 mg kg^{-1} dry weight), total potassium content in the fruits was (15.49 mg kg^{-1} dry weight), the total calcium content in the fruit is (3.11 mg kg^{-1} dry weight), the average length of the fruit was (16.63 cm $fruit^{-1}$), the average fruit weight is (81.78 g $fruit^{-1}$), The average fruit diameter is (2.76 cm $Fruit^{-1}$), the average number of fruits was (41.21. Fruit $plant^{-1}$). and the total yield is 3.76 tons a $greenhouse^{1}$.

The results showed that the superiority of the combination (2 g urea + 1.5 $ml.l^{-1}$ nano-calcium) significantly in all indicators of vegetative growth, yield characteristics and components studied, relative content of chlorophyll in leaves (50.08 SPAD), total nitrogen content in leaves (37.33 mg kg^{-1} dry weight), total phosphorous content in leaves (4.74 mg kg^{-1} dry weight), total potassium content in leaves (29.25 mg kg^{-1} dry weight), total calcium content in leaves (6.84 mg kg^{-1} dry weight), total nitrogen content in fruits (22.21 mg kg^{-1} dry weight), The total phosphorous content in the fruits was (3.10 mg kg^{-1} dry weight), the total potassium content in the fruits is (17.57 mg kg^{-1} dry weight) . The interaction between (2 g urea + 1.5 ml. l^{-1} nano-calcium) and (Yekta (V1) plants) had a significant effect on all studied parameters, relative content of chlorophyll in leaves (51.51 SPAD), total nitrogen content in leaves (38.90 mg kg^{-1} dry weight), total phosphorous content in leaves (4.88 mg kg^{-1} dry weight), total potassium content in leaves (30.08 mg kg^{-1} dry weight), total calcium content in leaves (7.03 mg kg^{-1} dry weight), total nitrogen content in fruits (22.85 mg kg^{-1} dry weight), content total phosphorous in fruits (3.19 mg kg^{-1} dry weight), total potassium content in fruits (18.07 mg kg^{-1} dry weight), total calcium content in fruits (5.62 mg kg^{-1} dry weight).

Keywords: Nano calcium, nitrogen, chemical characteristics, cucumber

Introduction

Chemical fertilizers are essential to solve nutrient deficiencies and soil fertility issues, which are used to achieve the highest yield in area units. Chemical fertilizers should be able to improve the quality of agricultural products as well as increase production (Hassani, Tajali et al. 2014). Researchers have directed that nutrients be made available through foliar application to overcome some of the obstacles that reduce the readiness of nutrients added through soil (Srivastava 1997). Different fertilizers are used to increase the yields and quality of vegetable crops. Therefore, it is responsible for increasing productivity to more than 50%, especially chemical fertilizers. The fertilizers produced by Nanotechnology, a modern trend in fertilizer production, meet the increase in productivity and reduce environmental pollution due to the lack of added quantity, and their active role in the speed of absorption and representation, with efficiency.

Nitrogen is an important and effective element for obtaining good green growth through its effect on photosynthesis, so it contributes to increasing yield and improving the quality of fruits. In a study conducted on cucumber plants, it was found that urea spraying at a concentration of 5000 mg. l^{-1} has an effect in increasing the number of leaves and the content of leaves from chlorophyll (Hossain, Monreal et al. 2008). Nanoparticles have a high capacity to penetrate and enter the tissues of different plants, especially added spray on the vegetable population (Shukla, Misra et al. 2016, Ruttkay-Nedecky, Krystofova et al. 2017, Tripathi, Singh et al. 2017). Calcium performs several functions in the plant, acting as a second sender in signaling and environmental responses and returning them again. It is also important to absorb nutrients in several ways by increasing leakage in their low molecular-weight solubility in severely calcium-deficient tissue cells through membrane disintegration and loss of cell parts (Goor 1973).

Calcium deficiency is linked to a number of physiological diseases that appear in some vegetable's crops, such as the rotting of the pink limb Blossom End Rot on cucumber and tomato crops. Calcium deficiency leads to the disintegration and weakness of the cell wall and membrane, which allows and facilitates diseases and insects to infect these spots and show rotten, bitter or empty. Researches have shown that the spraying of plants or fruits with a solution containing calcium, especially calcium nitrate or calcium chloride, reduced the incidence of these diseases, confirming that the cause is lack of calcium.
Fertilizers derived from nanotechnology are gaining attention in agriculture in recent researches (Ali and Al-Juthery 2017). The study that is conducted is to determine the effects of Nano fertilizers on the plant growth and the yield.

Materials and methods

Chemical characteristics

Relative content of chlorophyll in leaves (SPAD)

The relative content of chlorophyll in tomato leaves was estimated using a SPAD device. After adding the last batch of fertilizers by ten days, the reading was taken from five plants for each experimental unit. The mature and fully-widened leaves at the peak of their phthalic activity were selected. The average of five plants was taken with a Chlorophyll meter and measured in SPAD units (Jemison and Williams 2006).

Estimation of nutrients (N, P, K and Ca) in leaves and fruits

The fourth paper was taken from the developing top of six plants that were randomly selected from each treatment and washed with distilled water to remove the dust stuck on it as recommended (Fink 1984). It was then dried by the electric furnace at 75 C° for 48 hours, taking into account the continuous rotation of the models. It was then ground by an electric mill, then 0.2 g of each sample were selected and digested in the manner proposed by (Cresser and Parsons 1979) using sulfuric acid and peruric acid, adding 3 of So2H sulfuric acid and leaving the center with 14 hours Acid and perchloric concentrated at 1:1. Digestive leaves are placed on a hot plate at 90 m for (5-3) minutes until yellow fumes appear. They are left for 5 minutes until white fumes appear and then heated at high temperature for (2-1) minutes. Upon completion of digestion, the solution to the sample shall be a colorless fire. The solution shall then be cooled down to a 50 ml flask and completed with the water distilled to the mark. The following elements have been estimated.

Total nitrogen content in leaves and fruits (mg.kg^{-1} dry weight)

Nitrogen was estimated using a KJELDAHL device by taking 10 mL of the digested sample, placing it in the reaction paper and adding 10 mL of NaOH, with a concentration of 40%, after which the distillation was performed and the liberated ammonia was collected in a glass beaker containing 20 ml of boric acid 2%, adding two drops of Methyl Red and Bromocresol Green evidence mixture and then the ammonia collected in the HCl receptacle was corrected 0.04 and then applied the following formula.

$$\%N = \frac{reparative\ volume\ of\ acid * acid\ gage * mitigation\ volume}{Sample\ size\ taken\ when\ distilling\ *\ Digested\ sample\ weight * 100 * 1000}$$

Total phosphorus content in leaves and fruits (mg.kg-1 dry weight)

10 mL of the digested sample was taken and placed in a 50 mL flask and then the volume was completed to the mark by adding the distilled water and then 10 mL of the previous solution was dragged and 0.1 g **Skorpik** acid and 4 ml of the pre-prepared ammonium molybdate solution (10 g ammonium molybdate dissolved in 400 ml distilled water and then added 150 ml), the samples were heated on a hot plate for one minute until the solution became blue, the contents were moved to a 100 ml in the flask and fulling the flask to the marker with distilled water. The photometer readings were taken with the **Tonometer** and the Photometer Spectrometer at the longest Nanometer standard phosphorus curve by method in press (1989).

Relative content rate of chlorophyll in leaves (SPAD)

Table (1) illustrates the effect of Nano fertilizer and conventional spraying on the rate of plant altitude. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest rate of chlorophyll relative content (50.08 SPAD) compared to the treatment of spray with distilled water only (30.71 SPAD). The same table shows the effect of the item on the chlorophyll rate in the leaves. The first item (V1) had the highest rate (42.92 SPAD) compared with the second item (V2), which gave the lowest relative rate of chlorophyll in the leaves (40.52 SPAD).

The binomial overlap between combinations (Nano fertilizer and conventional) had an effect on the relative chlorophyll content rate (2 g urea + 1.5 ml^{-1} Nano-calcium), giving the highest chlorophyll rate in leaves (51.51 SPAD) in the plants of the species (V1) compared with the treatment giving the lowest rate (48.66 SPAD) in the plants of the variety (V2).

Table (1) The effect of spraying different concentrations of Nano fertilizers, metallic fertilizers and the class and their overlap in **(**SPAD**)** content in leaves (mg.kg-1)

	Fertilization method	Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	31.74q	29.67r	30.71k
T2	0.75 (ml. Liter -1) Nanocalcium	40.82hi	38.56l	39.69g
T3	1.5 (ml. Liter -1) Nanocalcium	41.54h	39.24lk	40.39f
T4	2 (ml. Liter -1) conventional calcium	39.68jk	37.48m	38.58h
T5	1 (gm. Liter-1) Urea	35.34o	33.38p	34.36j
T6	2 (gm. Liter-1) Urea	36.61n	34.58o	35.60i
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	49.83c	47.07e	48.45c
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	50.98ab	48.16d	49.57ab
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	42.67g	40.31ji	41.49e
T10	0.75 (ml. Liter -1) Nanocalcium and 2	50.65cb	47.85de	49.25b
	(gm. Liter-1) Urea	51.51a	48.66d	50.08a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	43.69f	43.69f	42.48d
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	31.74q	29.67r	30.71k

Average	42.92a	40.52b	

Estimation of NPK in leaves and fruits (mg.kg-1 dry weight)

Total nitrogen content in leaves (mg.kg-1 dry weight)

Table (3) shows the effect of spraying with Nano- and conventional fertilizers on the total nitrogen content in the leaves. The treatment (2 g urea + 1.5 ml-1 nano-calcium) gave the highest rate of total nitrogen content in the leaves to 37.33 mg.kg-1 dry weight (LW) compared with the treatment of spray with only distilled water (19.13 mg.kg-1 dry weight). The same table showed an effect of the item on the nitrogen content in the leaves. The first item (V1) had the highest rate (31.20 mg.kg-1 dry weight) compared with the second item (V2), which gave the lowest total nitrogen content in the leaves (29.46 mg.kg-1 dry weight).

The binomial overlap between combinations (Nano and traditional manure) had an effect on the total nitrogen content rate in the leaves. The transaction (2 g urea + 1.5 ml-1 Nano-calcium) gave the highest total nitrogen content in the leaves to 38.39 mg.kg-1 dry weight) in the plant of the item (V1) compared with the transaction that gave the lowest total nitrogen content to 18.49 mg.kg-1 dry weight in the plant of the item (V2).

Table (2) The effect of spraying different concentrations of Nano fertilizers, metallic fertilizers and the class and their overlap in total nitrogen content in leaves (mg.kg-1)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	**19.78n**	**18.49o**	**19.13j**
T2	0.75 (ml. Liter -1) Nanocalcium	**31.93g**	**30.16h**	**31.04f**
T3	1.5 (ml. Liter -1) Nanocalcium	**33.29f**	**31.44g**	**32.36e**
T4	2 (ml. Liter -1) conventional calcium	**26.28i**	**24.82j**	**25.55g**
T5	1 (gm. Liter-1) Urea	**22.23kl**	**21.00m**	**21.62i**
T6	2 (gm. Liter-1) Urea	**23.08k**	**21.80ml**	**22.44h**
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**36.03dbc**	**34.03ef**	**35.03c**
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**37.40a**	**35.33dbc**	**36.36b**
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	**34.95de**	**33.80de**	**33.98d**
T10	0.75 (ml. Liter -1) Nanocalcium and 2	**36.09bc**	**34.09ef**	**35.09c**

	(gm. Liter-1) Urea	**38.39a**	**36.26b**	**37.33a**
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	**35.03dec**	**35.03dec**	**34.06d**
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	**19.78n**	**18.49o**	**19.13j**
Average		**31.20a**	**29.46b**	

Total phosphorus content in leaves (mg.kg-1 dry weight)

Table (3) illustrates the effect of spraying with Nano - and conventional fertilizers on the total phosphorus content in the leaves. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest rate of total phosphorus content in the leaves at 4.74 mg.kg-1 dry weight, compared with the treatment of only distilled water spraying at 3.03 mg.kg-1 dry weight. The same table showed an effect of the item in phosphorus content in the leaves. The first item (V1) had the highest rate (3.97 mg.kg-1 dry weight) compared with the second item (V2), which gave the least total phosphorus content in the leaves (3.75 mg.kg-1 dry weight).
The binary overlap between combinations (Nano-fertilizer and conventional) had an effect on the total content rate of phosphorus in the leaves. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest total content of phosphorus in the leaves at 4.88 mg.kg-1 dry weight) in the plants of the item (V1) compared with the treatment that gave the lowest total content of phosphorus at 2.93 $mg.kg^{-1}$ dry weight in the plants of the item (V2).

Table (3) The effect of spraying different concentrations of Nano fertilizers, metallic fertilizers and the class and their overlap in the total phosphorus content of leaves ($mg.kg^{-1}$ dry weight)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	3.13n	2.93p	3.03k
T2	0.75 (ml. Liter -1) Nanocalcium	3.78i	3.57k	3.68g
T3	1.5 (ml. Liter -1) Nanocalcium	3.90h	3.69j	3.80f
T4	2 (ml. Liter -1) conventional calcium	3.48l	3.28m	3.38h
T5	1 (gm. Liter-1) Urea	3.22m	3.04o	3.13j
T6	2 (gm. Liter-1) Urea	3.28m	3.10no	3.19i
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	4.40e	4.16f	4.28c
T8	1 (ml. Liter -1) Nano calcium and 1(gm.	4.75b	4.48d	4.61b

	Liter-1) Urea			
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	4.00g	3.77i	3.89e
T10	0.75 (ml. Liter -1) Nanocalcium and 2	4.72b	4.46de	7.59b
	(gm. Liter-1) Urea	4.88a	4.61c	4.74a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	4.10f	3.87h	3.99d
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	3.13n	2.93p	3.03k
Average		3.97a	3.75b	

Total potassium content in leaves (mg.kg^{-1} dry weight)

Table (4) shows the effect of spraying with Nano- and traditional fertilizer on the total potassium content in the leaves. The treatment (2 g urea + 1.5 ml^{-1} nano-calcium) gave the highest rate of total potassium content in the leaves at (29.25 mg.kg-1 dry weight) compared with the treatment of only distilled water spray at (19.80 mg.kg^{-1} dry weight). The same table showed an effect of the item in the potassium content in the leaves. The first item (V1) had the highest rate (25.73 mg.kg^{-1} dry weight) compared with the second item (V2), which gave the lowest total potassium content in the leaves (24.29 mg.kg^{-1} dry weight).

The binomial overlap between combinations (Nano fertilizer and conventional) had an effect on the total content rate of potassium in the leaves. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest total nitrogen content in the leaves to 30.08 mg.kg^{-1} dry weight) in the plant of the variety (V1) as compared with the treatment that gave the lowest total content of the potassium to (19.13 mg.kg^{-1} dry weight) in the plants of the class (V2).

Table (4) Impact of spraying of different concentrations of nanofertilizers, metallic fertilizers and the class and their overlap in total potassium content in the leaves (mg.kg-1 dry weight)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	20.46p	19.13q	19.80i
T2	0.75 (ml. Liter -1) Nanocalcium	24.86ihg	23.49kl	24.18f
T3	1.5 (ml. Liter -1) Nanocalcium	25.17hg	23.78kj	24.47f
T4	2 (ml. Liter -1) conventional calcium	24.15ikj	22.81ml	23.48g
T5	1 (gm. Liter-1) Urea	22.20mn	20.97op	21.59h
T6	2 (gm. Liter-1) Urea	22.72ml	21.46on	22.09h

T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	27.93dc	26.39fe	27.16c
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	29.06p	27.45d	28.25b
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	26.09f	24.65ihg	25.37e
T10	0.75 (ml. Liter -1) Nanocalcium and 2	28.86b	27.26de	28.06b
	(gm. Liter-1) Urea	30.08a	28.42bc	29.25a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	24.86ihg	25.71fg	26.46d
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	20.46p	19.13q	19.80i
Average		25.73a	24.29b	

Total calcium content in leaves (mg.kg^{-1} dry weight)

Table 5 illustrates the effect of spraying with Nano and traditional fertilizer on the total calcium content in the leaves. The treatment (2 g urea + 1.5 ml^{-1} nano-calcium) gave the highest rate of total potassium content in the leaves (6.84 mg.kg^{-1} dry weight) compared with the treatment of only distilled water spray (1.02 mg.kg-1 dry weight). The same table showed an effect of the item in the potassium content in the leaves. The first item (V1) had the highest rate (3.87 mg.kg^{-1} dry weight) compared with the second item (V2), which gave the lowest total potassium content in the leaves (3.66 mg.kg^{-1} dry weight).

The binomial overlap between combinations (Nano fertilizer and conventional) had an effect on the total content rate of potassium in the leaves. The transaction (2 g urea + 1.5 ml^{-1} nano-calcium) gave the highest total nitrogen content in the leaves (7.03 mg.kg-1 dry weight) in the plants of the variety (V1) compared with the transaction that gave the lowest total content of potassium (0.95 mg.kg^{-1} dry weight) in the plants of the variety (V2).

Table 5 Impact of spraying of different concentrations of Nano fertilizers, metallic fertilizers and item and their overlap in total calcium content in leaves (mg.kg-1 dry weight)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	1.09s	0.95s	1.02l
T2	0.75 (ml. Liter -1) Nanocalcium	3.19m	3.05n	3.12h
T3	1.5 (ml. Liter -1) Nanocalcium	3.45l	3.26m	3.35g
T4	2 (ml. Liter -1) conventional	2.81o	2.65p	2.73i

	calcium			
T5	1 (gm. Liter-1) Urea	2.17q	2.05q	2.11j
T6	2 (gm. Liter-1) Urea	1.66r	1.57r	1.61k
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	4.86g	4.59h	4.72d
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	6.31c	6.08d	6.19b
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	3.83j	3.63k	3.73f
T10	0.75 (ml. Liter -1) Nanocalcium and 2	5.88e	5.55f	5.72c
	(gm. Liter-1) Urea	7.03a	6.65b	6.84a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	4.16i	3.87j	4.01e
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	1.09s	0.95s	1.02l
Average		3.87a	3.66b	

Total nitrogen content in fruits (mg.kg^{-1} dry weight)

Table 6 illustrates the effect of spraying with Nano and traditional fertilizers on the total nitrogen content of the fruit. The treatment (2 urea + 1.5 ml^{-1} nano-calcium) gave the highest rate of total nitrogen content in the fruit (22.21 mg.kg^{-1} dry weight) compared with the treatment of spray with distilled water only (12.17 mg.kg^{-1} dry weight). The same table showed an effect of the item on the nitrogen content of the fruit, with the first item (V1) having the highest rate (19.38 mg.kg^{-1} dry weight) compared with the second item (V2), which gave the lowest total nitrogen content in the fruit (18.30 mg.kg^{-1} dry weight).

The binomial overlap between combinations (Nano and traditional manure) had a effect on the total nitrogen content rate in the fruit, as the treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest total nitrogen content in the fruit (22.85 mg.1 kg^{-1} dry weight) in the plant of the variety (V1) compared with the treatment giving the lowest total nitrogen content of 11.76 mg.kg^{-1} dry weight) in the plant of the class (V2).

Table 6 Impact of spraying of different concentrations of Nano fertilizers, metallic fertilizers and class and their overlap in total nitrogen content in fruit (mg.kg-1 dry weight)

Fertilization method	Variety(V)		Mean effect of fertilizer coefficients
	V1 Yekta	V2	

			Maymon	
T1	Water spray	12.58j	11.76k	12.17j
T2	0.75 (ml. Liter -1) Nanocalcium	19.03f	17.98gh	18.50g
T3	1.5 (ml. Liter -1) Nanocalcium	19.34f	18.27g	18.80f
T4	2 (ml. Liter -1) conventional calcium	17.91gh	16.92i	17.41h
T5	1 (gm. Liter-1) Urea	17.80h	16.82i	17.31hi
T6	2 (gm. Liter-1) Urea	17.60h	16.62i	17.11i
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	21.28cd	20.10e	20.69c
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	22.13b	20.90d	21.52b
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	20.16e	19.04f	19.60e
T10	0.75 (ml. Liter -1) Nanocalcium and 2	21.49c	21.49c	20.89c
	(gm. Liter-1) Urea	22.85a	21.58c	22.21a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	20.46e	20.46e	19.90d
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	12.58j	11.76k	12.17j
Average		19.38a	18.30b	

Total phosphorus content in the fruit (mg.kg^{-1} dry weight)

Table 7 illustrates the effect of spraying with Nano and conventional fertilizers on the total phosphorus content of the fruit. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest total phosphorus content in the fruit (3.10 mg.kg^{-1} dry weight) compared to the treatment of spraying with only distilled water (2.09 mg.kg^{-1} dry weight). The same table shows an effect of the species on the phosphorus content of the fruits, with the first item (V1) having the highest rate (2.73 mg.kg^{-1} dry weight) compared with the second category (V2), which gave the least total phosphorus content in the fruit (2.58 mg.kg^{-1} dry weight).

The binary overlap between combinations (Nano-manure and traditional manure) had a effect on the total content rate of phosphorus in the fruit, as the treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest total phosphorus content in the fruit (3.19 mg.kg-1 dry weight) in the plant of the variety (V1) compared with the treatment that gave the lowest total phosphorus content (2.03 mg.kg^{-1} dry weight) in the plant of the variety (V2).

Table 7 Impact of spraying of different concentrations of Nano fertilizers, metallic fertilizers and the variety and their overlap in total phosphorus content in fruit (mg.kg-1)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	2.16n	2.03o	2.09j
T2	0.75 (ml. Liter -1) Nanocalcium	2.67h	2.52kj	2.59g
T3	1.5 (ml. Liter -1) Nanocalcium	2.69gh	2.54kj	2.61fg
T4	2 (ml. Liter -1) conventional calcium	2.61i	2.46l	2.53h
T5	1 (gm. Liter-1) Urea	2.49lk	2.36m	2.42i
T6	2 (gm. Liter-1) Urea	2.50lkj	2.37m	2.43i
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	2.90e	2.74g	2.82d
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	3.13b	2.96ed	3.04b
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	2.71gh	2.56ij	2.63f
T10	0.75 (ml. Liter -1) Nanocalcium and 2	2.97cd	2.80f	2.88c
	(gm. Liter-1) Urea	3.19a	3.01c	3.10a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	2.82f	2.82f	2.74e
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	2.16n	2.03o	2.09j
Average		2.73a	2.58b	

Total potassium content in fruits (mg.kg^{-1} dry weight)

Table 8 illustrates the effect of spraying with nanoparticles and traditional fertilizers on the total potassium content of the fruit. The treatment (2 urea + 1.5 ml^{-1} nano-calcium) gave the highest total potassium content in the fruit (17.57 mg.kg-1 dry weight) compared with the treatment of spray with only distilled water (11.48 mg.kg^{-1} weight). The same table showed an effect of the item on the content of potassium in fruit, with the first item (V1) having the highest rate (16.37 mg.kg^{-1} dry weight) compared with the second item (V2), which gave the lowest total potassium content in fruit (2.58 mg.kg^{-1} dry weight).

The binary overlap between combinations (Nano and traditional manure) had a effect on the total content rate of potassium in the fruit, as the treatment (2 g urea + 1.5 ml^{-1} Nanocalcium) gave the highest total phosphorus content in the fruit (18.07 mg.kg^{-1} dry weight) in the plant of the variety (V1) compared with the treatment that gave the lowest total content of the potassium (11.09 mg.kg^{-1} dry weight) in the plants of the class (V2).

Table 8 Impact of spraying of different concentrations of nanofertilizers, metallic fertilizers, and class and their overlap in the total potassium content of the fruit (mg. kg-1 dry weight)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	11.87q	11.09r	11.48k
T2	0.75 (ml. Liter -1) Nanocalcium	14.84k	14.02m	14.43h
T3	1.5 (ml. Liter -1) Nanocalcium	15.35j	14.50l	14.92g
T4	2 (ml. Liter -1) conventional calcium	14.84k	14.02m	14.43h
T5	1 (gm. Liter-1) Urea	13.40n	12.66p	13.03j
T6	2 (gm. Liter-1) Urea	13.81m	13.05o	13.43i
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	16.58fe	15.66hi	16.12d
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	17.80b	16.82d	17.31b
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	16.16g	15.27j	15.72f
T10	0.75 (ml. Liter -1) Nanocalcium and 2	16.78de	15.85h	16.31c
	(gm. Liter-1) Urea	18.07a	17.07c	17.57a
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	16.37fg	15.46ji	15.92e
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	11.87q	11.09r	11.48k
Average		15.49a	14.62b	

Total calcium content in fruits (mg.kg-1 dry weight)

Table 9 illustrates the effect of spraying with Nano and conventional fertilizer on the total calcium content of the fruit. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest rate of total calcium content in the fruit (5.47 mg.kg-1 dry weight) compared to the treatment of spray with only distilled water (0.79 mg.kg^{-1} dry weight). The same table showed an effect of the item on the nitrogen content of the fruit, with the first item (V1) having the highest rate (3.11 $mg.kg^{-1}$ dry weight) compared with the second item (V2), which gave the lowest total calcium content in the fruit (2.92 $mg.kg^{-1}$ dry weight).

The binary overlap between combinations (Nano-manure and traditional manure) had a effect on the total calcium content rate of the fruit, as the transaction (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest total calcium content in the fruit (5.62 $mg.kg^{-1}$ dry weight) in the plant of the variety (V1) compared with the transaction that gave the lowest total calcium content (0.76 $mg.kg^{-1}$ dry weight) in the plant of the item (V2).

Table 9 Impact of spraying of different concentrations of Nano fertilizers, metallic fertilizers and class and their overlap in total calcium content in fruit (mg.kg-1 dry weight)

Fertilization method		Variety(V)		Mean effect of fertilizer coefficients
		V1 Yekta	V2 Maymon	
T1	Water spray	0.82u	0.76u	0.79l
T2	0.75 (ml. Liter -1) Nanocalcium	2.57m	2.41n	2.49h
T3	1.5 (ml. Liter -1) Nanocalcium	2.76l	2.61m	2.68g
T4	2 (ml. Liter -1) conventional calcium	2.25o	2.12p	2.19i
T5	1 (gm. Liter-1) Urea	1.75q	1.64r	1.69j
T6	2 (gm. Liter-1) Urea	1.34s	1.25t	1.30k
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	3.90g	3.67h	3.79d
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	5.16c	4.84d	5.00b
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	3.10j	2.90k	3.00f
T10	0.75 (ml. Liter -1) Nanocalcium and 2	4.71e	4.44f	4.58c
	(gm. Liter-1) Urea	5.62a	5.31b	.47a5
T11	1 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	3.29i	3.09j	3.19e
T12	1.5 (ml. Liter -1) Nanocalcium and 2 (gm. Liter-1) Urea	0.82u	0.76u	0.79l
Average		3.11a	2.92b	

Discussion

The increase in the relative content of chlorophyll leaves in cucumbers (table 1) means a rise in the rate of photosynthesis. The increase in the relative content of chlorophyll in cucumber leaves may be attributed to the role of nitrogen in the manufacture of Porphyrins, which are used in the construction of chlorophyll pigment molecule. The reason for this is the activation of nitrogen for the process of building proteins and nucleic acids, which has led to the increase in the chlorophyll pigment in the cell. Chlorophyll is the basis of photosynthesis and is responsible for the process of food manufacturing in plants. Given the importance of nanoparticles, mineral fertilizers and the nutrients they contain help with the growth of the plant and increase the chlorophyll content of leaves. Increasing the chlorophyll content is important in activating the process of carbon representation as a result of the absorption of as much photoenergy as possible and its conversion to bioenergy within the plant in the optical system. The molecule plays an important role in building up the protein molecular structure green plastids, so 51% of foliage nitrogen is incorporated into chlorophyll pigments.

The leaf is one of the most important parts of the plant in which all physiological processes take place. It is one of the most suitable plant parts for judging the state of the nutrients ready in the soil solution and the nutritional status of the plant, as it is the vegetation in which the nutrients mix with the plant food and are linked to photosynthetic products. The increase in the content of the elements of NPK in the leaves and their relatively high levels is due to the role of the mineral spraying in appropriate quantities, which contribute to their more efficient absorption, their transfer to the vegetable total and their accumulation in the vegetation, resulting in increased concentration in the leaves. As well as the ready-to-grown elements, with rapid diffusion (the rapid growth of vegetable sewage). The discrepancy between the two classes may be attributed to differences in the absorption and representation rates of minerals.

Calcium is an important element by forming the middle plate in cells' walls in the form of calcium packets. It is also a salt for phosphatide acid, which is included in the structure of cell membranes and is important for maintaining their various permeability and effectiveness. Increasing the calcium content of the fruits increases their importance in the coherence of cell walls through its association with the acids, which increase the strength and rigidity of cell walls as well as its role in binding protein molecules into the cell membrane, making the membrane more durable and less permeable.

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