Nat. Volatiles & Essent. Oils, 2021; 8(6): 2602-2611

NVEO
Natural Volatiles &
Essential Oils

Effect Of Traditional And Nano Calcium Fertilizer And Nitrogen On Cucumber Plant Growth

Yahya I. Alyasiri and Karim M. Bhiah

Soil and Water Department, Faculty of Agriculture, University of Kufa, Najaf province, Iraq.

Abstract

The experiment was carried out in one of the unheated greenhouses in the sub-district of Al-Haidariya, which belongs to the **governorate** of Najaf Al-Ashraf in Iraq, during the fall season of 2019. To study the impact of the spraying of Nano-calcium fertilizer and traditional nitrogen on the growth of two varieties of cucumber plants, a practical experiment was carried out using the design of the Randomized Complete Block Design (RCBD). The experiment was carried out through two factors which are the **foliar fertilization** and the item class (which are **Yekta V1 and Maymon V2 varieties**). The average treatments were compared according to the Duncan test and at a probability level of **0.05.** Each process was repeated three times and they showed the following results-: Plants of the variety V1 are superior in all green growth indicators and the characteristics of the plant. The results indicate that the combination (2 g urea+ 1.5 ml-1 Nano calcium) is superior in all of the green growth indicators and the characteristics of the crop. The overlap between (2 g urea + 1.5 ml-1 Nano-calcium) and (V1) had a significant impact on all of the green growth indicators.

Keywords: nonfertilizer, conventional fertilizer, cucumber

Introduction

Chemical fertilizers are essential to fill nutrient deficiencies and soil fertility, which are used to achieve the highest yield in the area unit. 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 with soil (Srivastava 1997). Various fertilizers are used to increase the yield and quality of vegetable crops. Therefore, it is responsible for increasing productivity to more than 50%, especially chemical fertilizers. The fertilizers produced by nanotechnology are a modern trend in fertilizer production. This trend has been linked to the increment of productivity and reductant of the environmental pollution due to the lack of added quantities.

The availability of essential nutrients is vital for the growth of plants in terms of their participation or intake in some of the vital activities within the plant. The lack of any of them leads to a major disruption in growth, which is reflected in quantity and quality of the production. The availability of the basic elements is affected by several factors, including the soil content of organic matter, the mud content and the interaction of soil with its content of carbonate minerals. These nutrients are also exposed in some soils to many factors that limit their movement and their readiness to benefit the plant. In some cases, the plant in such soils does not respond to added fertilizers. The reason may be due to their low soil readiness and the low efficiency in the use of traditional fertilizers. The nutrients are considered to be the self-driven elements of the plants (May and Pritts 1993).

Cucumis sativus L. is one of the plants of the Cucurbitaceae family. It is one of the important summer green crops that man has known for centuries in most countries of the world, including Iraq, India, Central Africa, and China are their original habitats, as it was cultivated in these regions thousands of years ago. Cucumber is grown in Iraq in open fields (spring and autumn), and in protected environments under plastic greenhouses. Cucumbers contain 96% water and each 100 g of fruit contains 0.7 mg protein, 14 calories, 24 mg calcium, 20 universal units of vitamin A, 0.075 mg riboflavin (vitamin B2) and 0.3 mg of Niacin (vitamin B3). Cucumbers are consumed either fresh or pickled, and are also introduced into the diet as a result of cultural and social development in recent years (Wien and Stützel 2020). Also, it has benefits for the lowering of the blood pressure (Waseem, Kamran et al. 2008).

The total production average in the world for cucumber crops is 74,975,625 tons, while the total production average in Iraq is about 273,005 tons (FAO 2014). There is a decrease in Iraqi productivity compared to world productivity. This decrease may be attributed to the non-use of modern methods in agriculture and the deterioration of crop servicing, including fertilizers. Nurturing cucumber plants under protected agricultural conditions relies heavily on high-yields of plant chemical fertilizers to achieve the highest yield, which leads to soil degradation and long-term environmental pollution (Swer, Dkhar et al. 2011).

Fertilizers derived from nanotechnology are beginning to attract attention in agriculture through recent studies (Ali and Al-Juthery 2017). This study is discussing and determining the effects of Nano fertilizers on plant growth and their yield.

Materials and methods

Four plants were randomly taken per experimental unit of all samples to measure the green indices.

Plants height average

The height of four cucumber plants randomly measured from each test unit; the height of the main stem was measured from the soil level to the highest developing peak by the measuring tape.

Average number of total leaves (leaf. plant^{-1})

The number of leaves per test unit was calculated at random for the selected plants and the average number of leaves per plant.

Average leaf area (cm2 leaf^{-1})

The dry weight of the total for the randomly selected plants and for each randomly selected experimental unit. The plants were uprooted, except for the roots. The samples were dried in an electric furnace at 75° C for 48 hours until they were dried and the dry weight was weighed by a scale.

Dry weight average of total vegetative part (gm. plant $^{-1}$)

The leaf area was calculated in the manner described by **Sadik et al. (2011)** using the scanner of Digimizer computer-based software for four cucumber plants from each experimental unit by taking three full-width leaves from each plant for treatment. They were measured and then calculated the plant leaf area for each experimental unit.

Diameter of the stem (mm)

The Vernier caliper tool was used to measure the diameter of the stem at 1cm from the main stem's contact to the soil.

Results

Plants height average

Table (1) shows the effect of the spraying of Nano and traditional fertilizers on the average of plant height. The treatment (2 g urea + 1.5 ml-1 nano-calcium) gave the highest average of plant height (3.16 m) compared to the treatment of spraying only with distilled water (1.29 m). The same table shows an effect of the species on the average of plant height, with the first item (V1) having the highest average (2.53 m) compared with the second item (V2), which gave the lowest average of plant height (2.38 m.) The binary overlap between combinations (Nano fertilizer and conventional) has had an effect on the average of plant height. The treatment (2 g urea + 1.5 ml-1 Nano-calcium) gave the highest average of plant height (3.25 m) in the plant variety (V1) compared with the treatment that gave the lowest average (1.25 m) in the plant variety (V2.).

Table 1. The effect of spraying different concentrations of Nano fertilizers, minerals fertilizers and varieties and their overlap on the average height of the plant.

Fertilization method		Variety (V)		Mean effect of fertilizer coefficients
		V1 Yekta	**V2 Maymon**	
T1	Water spray	1.34 q	1.25 r	1.29 h
T2	0.75 (ml. Liter -1) Nano calcium	2.57 hg	2.42 j	2.49 d
T3	1.5 (ml. Liter -1) Nano calcium	2.66 f	2.51 hi	2.58 c
T4	2 (ml. Liter -1) conventional calcium	2.14 l	2.03 m	2.09 f
T5	1 (gm. Liter-1) Urea	1.94 on	1.83 p	1.89 g
T6	2 (gm. Liter-1) Urea	1.98 mn	1.87 op	1.93 g

T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	3.08 bc	2.91 e	2.99 b
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	3.22 a	3.04 dc	3.14 a
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	2.41 j	2.28 k	2.34 e
T10	0.75 (ml. Liter -1) Nano calcium and 2	3.13 b	2.96 de	3.04 b
	(gm. Liter-1) Urea			
T11	1 (ml. Liter -1) Nano calcium and 2 (gm. Liter-1) Urea	3.25 a	3.07 bc	3.16 a
T12	1.5 (ml. Liter -1) Nano calcium and 2 (gm. Liter-1) Urea	2.62 fg	2.47 ji	2.54 cd
	Average	**2.53 a**	**2.38 b**	

Average number of total leaves (leaf. plant^{-1})

Table (2) shows the effect of the spraying with nanoparticles and traditional fertilizers on the average number of total leaves. The treatment (2 g urea + 1.5 ml-1 Nano calcium) gave the highest average number of leaves (42.65 leaf. plant-1) compared with the treatment of only distilled water spray (23.09 leaf. plant-1). The same table shows the effect of the item on the average number of leaves, with the first item (V1) having the highest average (36.33 leaf. plant-1) compared with the second item (V2), which gave the lowest average number of leaves (34.35 leaf. plant-1).

The binary overlap between combinations (nano and traditional manure) has had a effect on the average number of leaves. The treatment (2 g urea + 1.5 ml-1 Nano calcium) gave the highest average of increase of the number of leaves (43.85 leaf. Plant-1) in the plants of the variety (V1) as compared with the treatment that gave the lowest average of leaves (.22.44 leaf. plant^{-1}) in the plants of the variety (V2).

Table (2) The effect of spraying different concentrations of nanomaterials, minerals fertilizers, and varieties and their overlap between the average number of leaves (leaf. plant-1)

Fertilization method		Variety (V)		Mean effect of fertilizer coefficients
		V1 Yekta	**V2 Maymon**	
T1	Only water	**23.74 g**	**22.44r**	**23.09j**

T2	0.75 (ml. Liter -1) Nano calcium	**36.90h**	**34.88j**	**35.89f**
T3	1.5 (ml. Liter -1) Nano calcium	**37.1ih**	**35.08j**	**36.09f**
T4	2 (ml. Liter -1) conventional calcium	**33.33k**	**31.51l**	**32.42g**
T5	1 (gm. Liter-1) Urea	**30.2 n**	**28.59p**	**29.42i**
T6	2 (gm. Liter-1) Urea	**31.10m**	**29.40o**	**30.25h**
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**38.97f**	**36.84h**	**37.91d**
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**43.44b**	**41.06d**	**42.25b**
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	**37.84g**	**35.77i**	**36.80e**
T10	0.75 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**39.18f**	**37.04h**	**38.11d**
T11	1 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**43.85a**	**41.45c**	**42.65a**
T12	1.5 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**40.34e**	**38.13g**	**39.23c**
	Average	**36.33a**	**34.35b**	

Average leaf area (cm2 leaf^{-1})

Table (3) shows the effect of the spraying with nanoparticles and traditional fertilizers on the average leaf area. The treatment (2 g urea + 1.5 ml-1 nano-calcium) gave the highest average leaf area average (139.49 cm2 leaf-1) compared with the treatment of spray with only distilled water (44.84 cm2 leaf-1). The same table shows an effect of the item on the leaf area average, with the first item (V1) having the highest average (110.76 cm2 leaf^{-1}) compared with the second item (V2), which gave the lowest height average (104.59 cm2 leaf^{-1}).

The binary overlap between combinations (Nano-manure and traditional manure) had a effect on the average leaf area, as the treatment (2 g urea + 1.5 ml-1 Nano-calcium) gave the highest average of increase of leaf area (143.47 cm2 leaf-1) in the plants of the item (V1) compared with the treatment that gave the lowest average (143.47 cm2 leaf-1) in the plants of the item (V2).

Table (3) The effect of spraying different concentrations of nanomaterials, minerals fertilizers, and varieties and their overlap with the Average leaf area (cm2 leaf^{-1})

Fertilization method		Variety (V)		Mean effect of

		V1 Yekta	V2 Maymon	fertilizer coefficients
T1	Only water	46.35q	43.33q	44.84j
T2	0.75 (ml. Liter -1) Nano calcium	109.80ji	103.72k	106.76f
T3	1.5 (ml. Liter -1) Nano calcium	112.7hi	106.52jk	109.64e
T4	2 (ml. Liter -1) conventional calcium	97.52l	92.12m	94.82g
T5	1 (gm. Liter-1) Urea	76.85no	72.59p	74.72i
T6	2 (gm. Liter-1) Urea	80.63n	76.17po	78.40h
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	133.75bc	126.34fe	130.04b
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	143.06a	135.13b	139.09a
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	120.54g	113.87h	117.20d
T10	0.75 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	134.26b	126.82de	130.54b
T11	1 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	143.47a	135.52b	139.49a
T12	1.5 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	130.16dc	122.95fg	126.56c

Dry weight average of total vegetative part (gm. plant -1)

Table (4) shows the effect of spraying with nanoparticles and traditional fertilizers on the Dry weight average of total vegetative part. The treatment (2 g urea + 1.5 ml^{-1} Nano calcium) gave the highest Dry weight average of total vegetative part (39.60 gm. $plant^{-1}$) as compared with the treatment of spraying with only distilled water (21.76 g gm. $plant^{-1}$). The same table shows an effect of the item in the Dry weight average of total vegetative part, with the first item (V1) having the highest average (30.39 gm. $plant^{-1}$) compared with the second item (V2), which gave the lowest dry weight average (28.69 gm. $plant^{-1}$).

The binary overlap between combinations (Nano-fertilizer and traditional fertilizer) had an effect on Dry weight average of total vegetative part, as the treatment (2 urea + 1.5 ml^{-1} Nano-calcium) gave the highest Dry weight average of total vegetative part (40.72 gm. $plant^{-1}$) in the plant of the species (V1) as compared with the treatment that gave the lowest average (21.02 gm. $plant^{-1}$) in the plant of the species (V2).

Table (4) The effect of spraying different concentrations of Nano fertilizers, minerals fertilizers, and varieties and their overlap between the dry weight average of total vegetative part (gm. plant^{-1})

Fertilization method		Variety (V)		Mean effect of fertilizer coefficients
		V1 Yekta	**V2 Maymon**	
T1	Only water	**22.49q**	**21.02r**	**21.76k**
T2	0.75 (ml. Liter -1) Nano calcium	**26.70kl**	**25.23on**	**25.97h**
T3	1.5 (ml. Liter -1) Nano calcium	**27.32kj**	**25.81mn**	**26.56g**
T4	2 (ml. Liter -1) conventional calcium	**26.19ml**	**24.74o**	**25.47i**
T5	1 (gm. Liter-1) Urea	**24.86o**	**23.49p**	**24.18j**
T6	2 (gm. Liter-1) Urea	**25.17o**	**23.78p**	**24.47j**
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**36.43e**	**34.41g**	**35.42d**
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**39.60b**	**37.41d**	**38.50b**
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	**28.14i**	**26.58l**	**27.36f**
T10	0.75 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**37.45d**	**35.38f**	**36.41c**
T11	1 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**40.72a**	**38.47c**	**39.60a**
T12	1.5 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**29.57h**	**27.93ij**	**28.75e**
Average		**30.39a**	**28.69b**	

Diameter of the stem (mm)

Table (5) shows the effect of the spray with nonconventional fertilizer on the diameter of the stem. The treatment (2 g urea + 1.5 ml^{-1} Nano-calcium) gave the highest diameter average of 19.02 mm compared with the treatment of 11.98 mm with distilled water only. The same table shows an effect of the item on the diameter average of the stem, with the first item (V1) having the highest average (16.70 mm) compared to the second (V2), which gave the lowest diameter average (15.77 mm).

The binomial overlap between combinations (Nano and traditional fertilizers) has had an effect on the plant's stem diameter average. The treatment (2 g urea + 1.5 ml^{-1} nano calcium) gave the highest average of increase in the stem diameter average (19.56 mm) in the plant variety (V1) compared with the treatment that gave the lowest average (11.58 mm) in the plant variety (V2).

Table (5) The impact of spraying different concentrations of Nano fertilizers, minerals fertilizers, and class, and their overlap in stem diameter (mm)

Fertilization method		Variety (V)		Mean effect of fertilizer coefficients
		V1 Yekta	**V2 Maymon**	
T1	Only water	**12.39p**	**11.58q**	**11.98j**
T2	0.75 (ml. Liter -1) Nano calcium	**16.27jk**	**15.37l**	**15.82g**
T3	1.5 (ml. Liter -1) Nano calcium	**16.81hi**	**15.88k**	**16.34f**
T4	2 (ml. Liter -1) conventional calcium	**16.06jk**	**15.17lm**	**15.62g**
T5	1 (gm. Liter-1) Urea	**14.22n**	**13.43o**	**13.81i**
T6	2 (gm. Liter-1) Urea	**14.84m**	**14.02n**	**14.43h**
T7	0.75 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**18.21d**	**17.20fgh**	**17.71d**
T8	1 (ml. Liter -1) Nano calcium and 1(gm. Liter-1) Urea	**19.13ab**	**18.07de**	**18.60b**
T9	1.5 (ml. Liter -1) Nano calcium and 1 (gm. Liter-1) Urea	**16.88gh**	**15.95jk**	**16.42f**
T10	0.75 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**18.72bc**	**17.69ef**	**18.21c**
T11	1 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**19.56a**	**18.48cd**	**19.02a**
T12	1.5 (ml. Liter -1) Nano calciumand 2 (gm. Liter-1) Urea	**17.34fg**	**16.38ij**	**16.86e**
	Average	**16.70a**	**15.77b**	

Discussion and conclusion

Tables (1, 2 and 3) show an increase in the height of plant, total number of leaves and average leaf area with the addition of different levels of Nano-fertilizers and mineral fertilizers. This can be attributed to the genetic factor having an effect on the variability of the species' response and their interference with different environmental factors, or as a result of the direct effect of nitrogen as the essential element for building amino acid, which forms the basis for building the growth hormone IAA and is responsible for lengthening plant cells. Increased concentrations of fertilizers used, whether Nano or mineral, stimulate the plant to increase the production of oxins, which has an impact on increasing activity of the stillage and increasing cell division and stenosis, or the readiness of the essential materials needed by the plant in the construction process, such as amino acids and certain enzyme facilities, such as NAD and NADP, in which the nitrogen element is inserted, as well as increased production of the gene it extends the cells and thus increases the plant's height. Phosphorus also has an effective role in stimulating enzyme reactions to the construction of biological compounds and in increasing the effectiveness of the photosynthesis process in plants. The increase in the quality of the leaves means an increase in the efficiency of the source in receiving as much sunlight as possible, which leads to an increase in the output of the photosynthetic. The variety has been morally different in the number of its leaves and may be attributed to an influence on the quality of plants in the variety of leaves. The increase in the number of leaves may be attributed to the role of nano and mineral fertilizers in stimulating the production of certain plant hormones such as IAA and Gabriline, which prolong the plant and form vegetable shoots, and consequently increase the number of leaves, or may be attributed to the efficient absorption of the vital elements. The increase in the relative content of chlorophyll leaves in cucumbers (table 5) means a rise in the average 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 dyes 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 dyes in the cell. Chlorophyll is the basis of photosynthesis and is responsible for the process of food manufacturing in plants. The higher the level of fertilizers and the higher the increase in the level of fertilizer and the increase in the level of fertilization and the addition of fertilizer. The longest and freer stages of plant growth that lead to increased chlorophyll formation and therefore increase photosynthesis and improve total plant growth. Given the importance of nanoparticles, mineral fertilizers and the nutrients they contain to help plant growth, which in turn will promote the growth of girls in a good way, which will increase the chlorophyll content of leaves. Increasing the content of chlorophyll is important in activating the process of carbon representation as the maximum possible absorption of photoenergy and conversion to plant bioenergy in the optical system. The Nitrogen has an important role in building the structure of protein by constructing molecules green steroids so 51% of foliage nitrogen is incorporated into chlorophyll pigments.

References

1. Ali, N. and H. Al-Juthery (2017). "The application of nanotechnology for micronutrient in agricultureal production." The Iraqi Journal of Agricultural Science **48**(4): 984.
2. FAO (2014). Statistical Agriculture. Rome .Italy, Food and Agriculture Organization of the United Nations.
3. Hassani, A., A. A. Tajali and S. M. H. Mazinani (2014). "Studying the Conventional Nano-Fertilizer Quantitative Yield (Mentha."

4. May, G. M. and M. P. Pritts (1993). "Phosphorus, Zinc, and Boron Influence Yield Components inEarliglow'Strawberry." Journal of the American Society for Horticultural Science **118**(1): 43-49.
5. Srivastava, P. (1997). "Biochemical significance of molybdenum in crop plants." Molybdenum in agriculture.: 47-70.
6. Swer, H., M. Dkhar and H. Kayang (2011). "Fungal population and diversity in organically amended agricultural soils of Meghalaya, India." Journal of Organic Systems **6**(2): 3-12.
7. Waseem, K., Q. Kamran and M. Jilani (2008). "Effect of different nitrogen levels on growth and yield of cucumber (Cucumis sativus L.)." Journal of Agricultural Research (Pakistan).
8. Wien, H. C. and H. Stützel (2020). The physiology of vegetable crops, CABI.