Role of NPK, root stimulator and Nano micronutrients on growth of Citrus Rootstock Rangpur.

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Abstract

The experiment was carried out at a Research Station B / Department of Horticulture and Landscape Gardening/ College of Agricultural Engineering Sciences / University of Baghdad during the growth season 2022-2021 on the seedlings of citrus rootstock Rangpur, seedlings were chosen homogeneous in size as much as possible to study the effect of three factors, The first factor is fertilization with balanced NPK in three concentrations, without addition (F0), 2 gm. seedlings^{-1} (F1) and 4gm seedlings-^{1} (F2) The second factor is the root stimulator with three concentrations, which is without addition (R0)5 ml L-^{1} (R1), and 10 ml L-^{1} (R2). The third factor is spraying with two concentrations of Nano-micronutrients without spraying,(N0), with spraying 1 gm L-^{1} (N1). A factorial experiment in a randomized complete block design (RCBD) was carried out, (3 concentrations of NPK x 3 concentrations of Root stimulator x 2 concentrations of Nano-micronutrients) with 3 replicates, and 3 plants in an experimental unit, So that the number of seedlings included in the experiment was 162 seedlings. NPK fertilization showed that there were significant differences in increasing the rates for studied traits, where the concentration (4gm seedlings^{-1}) shows that there were significant differences in plant height, the main stem diameter, Leaves number, leaf area, dry matter percentage of the shoot and chlorophyll concentration values were (46.33 cm, 3.283 mm, 107.06 leaf plant $^{-1}$, 32.57 cm^{2}, 53.22 gm, 2.37 mg gm^{-1}) respectively. As for the root stimulator, the concentration (10 ml L-^{1}) showed that there were significant differences in plant height, Leaves number, leaf area, the main stem diameter, dry matter percentage of the shoot, and chlorophyll concentration, values were (49.50 cm,30.28 leaf plant $^{-1}$,31.99 cm ^{2},3.433mm, 54.67g,2.33 mg gm^{-1}) respectively. The Spraying with Nano-micronutrients with concentration 1g L^{-1} showed the highest rates in plant height, leaf area, main stem diameter, dry matter percentage of shoot, and chlorophyll concentration, values were (44.37 cm, 31.31 cm^{2}, 3.037 mm, 50.96 g, 2.29 mg gm-1) respectively compared to other treatments.

Keywords: NPK, Nano Micronutrients, root stimulator, citrus rootstock

Introduction

Citrus, genus of plants belonging to the rue family (Rutaceae). The genus Citurs is considered one of the most important genera, as it includes most Economically important species and varieties of citrus because it adapts to a wide range of environmental conditions(20) . Most citrus species abound by grafting on different citrus rootstocks To obtain trees with strong growth and high productivity, Its specifications are good and it is resistant to environmental conditions and diseases his is done by choosing rootstock with good specifications which is Intend to Transferring the growing graft on it Where the root chosen according to its compatibility with the graft grown on it (14) .The root of *Citrus Limonia* Rangpur excel to bears the characteristics of *Citrus Sinensis* and *Poncirus Trifoliata* It is tolerant of drought and salinity. It is one of the stimulating rootstocks , compatible with a large number of citrus fruits. It is highly resistant to rapid deterioration disease. It tolerates heavy soils. However, it is sensitive to groundwater rising when grafting onto the rootstocks. Citrus is one of the economic inputs that can be increased by using good roots and varieties and modern scientific methods to serving the crop(13) . Fertilization with major elements is one of the necessary processes that are carried out for plants in order to obtain strong seedlings in their vegetative growth. and root,The importance of using organic fertilizers is due to the fact that they contain humic and fulvic acids, amino acids and other substances that are inexpensive, easy to use and environmentally friendly and contribute to improving the physical, chemical and biological properties of the soil, and this is reflected positively on plant growth and production (3).These substances are absorbed by t plants roots and easily released their ions and transported fastly in order for plant to benefit from them through their participation in physiological processes, which provides the plant with needed energy to absorb them, especially in the critical stages of growth(15). Organic fertilizers and the method of adding them effect on characteristics of vegetative growth, which gives yield increase in quantity and quality(16) .and improves the chemical characteristics of the plant(19). The addition of spray on leaves specially with micronutrients, because of the lower added of their concentrations, so there is no burn or negative effect when is addition at appropriate concentration and time, and this addition remains complementary to the ground addition, especially for the macronutrients (5) .Nano fertilizers are smart fertilizers that raise the efficiency of prepared mineral fertilizers , it possesses specifications such as high surface area and slow release also environmentally friendly when prepared and manufactured in the green way when loaded on natural, biological or chemical materials, added in small quantities, and achieves high and good results Economically(18) . It is also an effective alternative to usual fertilizers that can be stored for long periods due to high stability under various conditions (17).The aim that nutritional and soil fertility scientists want to reach is the compatibility between the release of any fertilizer formula used and the requirements and stage of plant growth in order to reach higher absorption efficiency, environmental pollution, and lower cost

(7). The aimed of this research is possibility to increasing the vegetative and root growth of citrus seedlings, the rootstock of Ranjpur, to accelerate the grafting process on this rootstock, through the addition of NPK and the root stimulator, and spraying with nano-micronutrients, as well as studying the characteristics of this rootstock and its tolerance to hot summer conditions, as it is considered one of the promising rootstock in Iraq.

Materials And Methods

The experiment was carried out at a Research Station B / Department of Horticulture and landscape Gardening/ College of Agricultural Engineering Sciences / University of Baghdad , during the growth season 2022-2021 , To study the effect of fertilization with three levels of neutral NPK 20:20:20 with three concentrations. , without addition (F0)2gm.seedlings^{-1} (F1) and 4gm seedlings-^{1} (F2) . The second factor is root stimulator with three concentrations, which is without addition (R0)5 ml L-^{1} (R1) and 10 ml L-^{1} (R2). The third factor is spraying with two concentrations of nano-micronutrients without spraying,(N0),with spraying 1gm L-^{1} recommended(N1). The growth of citrus origin in Rangpur , A factorial experiment in a randomized complete block design (RCBD) carried out, (3 concentrations of NPK x 3 concentrations of Root stimulator x 2 concentrations of nano-micronutrients) with 3 replicates, and 3 plants in an experimental unit, So that the number of seedlings included in the experiment was 162 seedlings, study results were statistically analyzed and means were compared according to L.S.D at 0.05 probability.(2).

Measured Characteristic

Characteristics Of Vegetative Growth

Sapling heights (cm**)** Take the average of seedling height at the beginning of the experiment and at the end of the experiment and extract the Difference

Stem diameter (mm) was measured using the electronic foot (Vernier). The reading was taken for the diameter of the stem above the grafting area by 10 cm. It was measured at the beginning and at the end of the experiment. The average increase in the diameter of the main stem was calculated from the difference between the two readings

leaves number (leaf seedling^{-1}) The number of leaves for each seedling within the treatment was and for each replicate, and then the average was extracted

Leaf area (cm2) was calculated using disks method, according to Dvornic *et al*. (11) .

Shoot Dry weight (%) was calculated after the seedlings were extracted at the end of the experiment. The shoot was separated from the root shoot and washed with water. The shoot was placed in perforated bags and the shoot was dried until the weight stabilized

Leaves chlorophyll content (mg g-1 fresh weight).The total chlorophyll content of the leaves was estimated based on method presented by the scientist (10).

Results and Disscussion

Plant height (cm) Results of Table (1) show that there were significant differences on plant height for treatment

F2 (4g seedlings-1) which it gave the highest rate 46.33 cm compared to treatment F0 (without addition) which gave the lowest rate 40.00 cm, an increase of 15.82%. We also notice that the root stimulator had a significant effect on plant height for treatment R2 (10 ml liter-1) which it gave the highest rate 49.50 cm compared to treatment R0 (without addition), which reached 36.89 cm, with an increase rate of 34.18%. The results in the table indicate that spraying with nano-fertilizer had a significant differences on plant height increasing, reaching 44.37 cm in treatment N1 (1 gm L-1) compared to treatment N0 (without addition), which gave the lowest rate 41.30 cm, with an increase of 7.43. The effect of the interaction of this study factors, showed a significant value between fertilization with NPK and root stimulator, which the treatment F2R2 gave the highest rate of plant height increasing, reaching 55.83 cm, compared to treatment F0R0, which it gave the lowest rate 35.00 cm. The interaction of this study factors, showed a significant value between NPK fertilization and Nano-fertilizer, the treatment F2N1 gave the highest rate in the same trait, and it reached 47.44 cm ,while F0N0 treatment gave the lowest rate of 38.33 cm . The results showed in the same table significant value of the interaction between the root stimulator and the Nano-fertilizer the treatment R2N1 recorded the highest rate of plant height increase 51.33 cm compared to the treatment R0N0, which recorded the lowest rate of 35.22 cm. As for the triple interaction, the results indicate that treatment F2R2N1 gave the highest rate of plant height, 57.00 cm, compared to the control treatment F0R0N0, which gave the lowest rate 33.76 cm. This increase may be attributed to the higher content of added elements in fertilized seedlings and their impact on photosynthesis and chlorophyll formation, which in turn stimulate growth and improve plant height. These results are consistent with those obtained by Hassan (15) in Bitter orange plants.

Table 1. Effect of NPK, root stimulator and spraying with Nano-micronutrients on plant height increase (cm) of citrus rootstock seedlings Rangpur

(F) effect of NPK	Effect of root stimulator	The effect of Nano fertilizer		FxR
		N0 (without addition)	N1 (1g L-1)	
F0 (without addition)	(zero)R0	33.67	36.33	35.00
	R1 5 ml L^{-1}	38.67	41.33	40.00
	R2 10 ml L^{-1}	42.67	47.33	45.00
F1(2 gm seedling^{-1})	R0	34.33	39.33	36.83
	R1	41.00	43.00	42.00
	R2	45.67	49.67	47.67
F2(4 gm seedling^{-1})	R0	37.67	40.00	38.83

	R1	43.33	45.33	44.33
	R2	54.67	57.00	55.83
LSD		3.967		2.805
		Effect F		
	F0	38.33	41.67	40.00
F × N	F1	40.33	44.00	42.17
	F2	45.22	47.44	46.33
LSD		2.290		1.620
		Effect R		
	R0	35.22	38.56	36.89
R × N	R1	41.00	43.22	42.11
	R2	47.67	51.33	49.50
LSD		2.290		1.620
Effect N		41.30	44.37	
LSD		1.322		

Plant leaves number(leaf plant^{-1})

Results of Table (2) show that there were significant differences on plant leaves number for treatment F2 (4g seedlings-1) which it gave the highest rate 129.06 leaf plant-1, compared to treatment F0 (without addition) which gave the lowest rate 107.06 leaf plant-1, an increase of 20.54. We also notice that the root stimulator had a significant effect on plant leaves number for treatment R2 (10 ml liter-1) which it gave the highest rate 130.28 leaf plant^{-1} compared to treatment R0 (without addition),which reached 113.39 plant leaf^{-1} with an increase rate of 14.89.The results in the table indicate that spraying with nano-fertilizer did not have a significant effect on this characteristic.The effect of the interaction of this study factors, showed a significant value between fertilization with NPK and root stimulator, which gave the highest rate of plant leaves number reaching 134.83 leaf Plant^{-1}, compared to the control treatment, which gave the lowest rate of 97.50 leaf Plant^{-1}. The interaction of this study factors, showed a significant value between NPK fertilization and Nano-fertilizer, the treatment F2N1 gave the highest rate in the same trait and it reached 130.67 leaf plant-1,while F0N0 treatment gave the lowest rate 105.11 leaf plant-1. The results showed in the same table significant value of the interaction between the root stimulator and the Nano-fertilizer the treatment R2N1 recorded the highest rate of plant leaves number 131.67 leaf plant^{-1} compared to the treatment R0N0, which recorded the lowest rate of 111.56 As for the triple interaction, the results indicate that treatment F2R2N1 gave the highest rate of plant leaves number, 136.00 leaf plant-1, compared to the control treatment F0R0N0, which gave the lowest rate 94.33 leaf plant^{-1},The increase in leaves number may be attributed to the essential elements present in the added fertilizers, which promote plant growth. These results are consistent with those found by Ghafouri and Aldulaimi (12) in a study conducted on local orange plants grafted onto sour orange rootstock.

Table 2. Effect of NPK, root stimulator and spraying with Nano-micronutrients on plant leaves number(leaf plant^{-1})of citrus rootstock seedlings Rangpur

(F) effect of NPK	Effect of root stimulator	The effect of Nano fertilizer N0 (without addition)	N1 (1g L-1)	FxR
F0 (without addition)	(zero)R0	94.33	100.67	97.50
	R1 5 ml L^{-1}	95.33	97.67	96.50
	R2 10 ml L^{-1}	125.67	128.67	127.17
F1(2 gm seedling^{-1})	R0	113.67	117.00	115.33
	R1	104.00	106.67	105.33
	R2	127.33	130.33	128.83
F2(4 gm seedling^{-1})	R0	126.67	128.00	127.33
	R1	122.00	128.00	125.00
	R2	133.67	136.00	134.83
LSD		11.132		7.871
		Effect F		
F × N	F0	105.11	109.00	107.06
	F1	115.00	118.00	116.50
	F2	127.44	130.67	129.06
LSD		6.427		4.545
		Effect R		
R × N	R0	111.56	115.22	113.39
	R1	107.11	110.78	108.94
	R2	128.89	131.67	130.28
LSD		6.427		4.545
Effect N		115.85	119.22	
LSD		3.711		

Leaf area (cm^2) Results of Table (3) show that there were significant differences on Leaf area for treatment F2 which it gave the highest rate 32.57 cm^2 compared to treatment F0 which gave the lowest rate 29.39 cm^2, with an increase of 10.82%. We also notice that the root stimulator had a significant effect on Leaf area for treatment R2 which it gave the highest rate 31.99 cm^2 compared to treatment R0 ,which reached 29.95 cm^2, with an increase rate of 6.81%The results in the table indicate that spraying with nano-fertilizer had a significant differences on Leaf area increasing, reaching 31.31 cm^2 in treatment N1 compared to treatment N0, which gave the lowest rate 30.36 cm^2, with an increase of 3.12%..

The effect of the interaction of this study factors, showed a significant value between fertilization with NPK and root stimulator, which the treatment F2R2 gave the highest rate of Leaf area increasing, reaching 33.63 cm^2, compared to treatment F0R0, which it gave the lowest rate 28.77 cm^2. The interaction of this study factors,

showed a significant value between NPK fertilization and Nano-fertilizer, the treatment F2N1 gave the highest rate in the same trait, and it reached 32.70 cm^2 ,while F0N0 treatment gave the lowest rate of 28.70 cm^2. The results showed in the same table significant value of the interaction between the root stimulator and the Nano-fertilizer the treatment R2N1 recorded the highest rate of Leaf area increase 32.60 cm^2 compared to the treatment R0N0, which recorded the lowest rate of 29.66 cm^2 . As for the triple interaction, the results indicate that treatment F2R2N1 gave the highest rate of Leaf area, 33.77 cm^2, compared to the control treatment F0R0N0, which gave the lowest rate 28.00 cm^2.,This increase in leaf area can be attributed to the increase in chlorophyll content in leaves. These results are consistent with those obtained by Boughalleb et al. (9) in lemon plants.

Table 3. Effect of NPK, root stimulator and spraying with Nano-micronutrients on Leaf area (cm^2) of citrus rootstock seedlings Rangpur

(F) effect of NPK	Effect of root stimulator	The effect of Nano fertilizer N0 (without addition)	N1 (1g L-1)	FxB
F0 (without addition)	(zero)R0	28.00	29.53	28.77
	R1 5 ml L^{-1}	28.30	29.23	28.77
	R2 10 ml L^{-1}	29.80	31.50	30.65
F1(2 gm $seedling^{-1}$)	R0	29.60	29.57	29.58
	R1	29.37	31.30	30.33
	R2	30.83	32.53	31.68
F2(4 gm $seedling^{-1}$)	R0	31.37	31.63	31.50
	R1	32.43	32.70	32.57
	R2	33.50	33.77	33.63
LSD			2.132	1.508
		Effect F		
F × N	F0	28.70	30.09	29.39
	F1	29.93	31.13	30.53
	F2	32.43	32.70	32.57
LSD			1.231	0.870
		Effect R		
R × N	R0	29.66	30.24	29.95
	R1	30.03	31.08	30.56
	R2	31.38	32.60	31.99
LSD			1.231	0.870
Effect N		30.36	31.31	
LSD			0.711	

The increase of stem diameter (mm) Results of Table (4) show that there were significant differences on stem diameter for treatment F2 which it gave the highest rate 3.283 mm compared to treatment F0 which gave the lowest rate 2.689 mm , with an increase 22.08% We also notice that the root stimulator had a significant effect on stem diameter for treatment R2 which it gave the highest rate 3.433 mm compared to treatment R0 ,which reached 2.700 mm , with an increase rate of 27.14%. The results in the table indicate that spraying with nano-fertilizer had a significant differences on stem diameter increasing, reaching 3.037 mm in treatment N1 compared to treatment N0, which gave the lowest rate 2.889 mm , with an increase of 5.12%.

The effect of the interaction of this study factors, showed a significant value between fertilization with NPK and root stimulator, which the treatment F2R2 gave the highest rate of stem diameter increasing, reaching 3.883 mm, compared to treatment F0R0, which it gave the lowest rate 2.400 mm. The interaction of this study factors, showed a significant value between NPK fertilization and Nano-fertilizer, the treatment F2N1 gave the highest rate in the same trait, and it reached 3.300 mm ,while F0N0 treatment gave the lowest rate of 2.589 mm. The results showed in the same table significant value of the interaction between the root stimulator and the Nano-fertilizer the treatment R2N1 recorded the highest rate of plant height increase 3.533 mm compared to the treatment R0N0, which recorded the lowest rate of 2.622 mm. As for the triple interaction, the results indicate that treatment F2R2N1 gave the highest rate of stem diameter, 3.867 mm, compared to the control treatment F0R0N0, which gave the lowest rate 2.267 mm.This increase may be attributed to the presence of a sufficient amount of nitrogen, phosphorus, potassium, and necessary trace elements in the process of photosynthesis, which reflects an increase in stem diameter. These results are consistent with those obtained by Alflahi and Aljanabi (4) in local orange seedlings grafted onto rootstock.

Table 4. Effect of NPK, root stimulator and spraying with Nano-micronutrients on The increase of stem diameter (mm) of citrus rootstock seedlings Rangpur

(F) effect of NPK	Effect of root stimulator	The effect of Nano fertilizer N0 (without addition)	N1 (1g L-1)	FxR
F0 (without addition)	(zero)R0	2.267	2.533	2.400
	R1 5 ml L^{-1}	2.467	2.600	2.533
	R2 10 ml L^{-1}	3.033	3.233	3.133
F1(2 gm seedling^{-1})	R0	2.633	2.900	2.767
	R1	2.633	2.667	2.650
	R2	3.167	3.500	3.333

	R0	2.967		2.900	2.933
F2(4 gm seedling^{-1})	R1	3.033		3.133	3.083
	R2	3.800		3.867	3.833
LSD			0.3083		0.2180
		Effect F			
	F0	2.589		2.789	2.689
F × N	F1	2.811		3.022	2.917
	F2	3.267		3.300	3.283
LSD			0.1780		0.1259
		Effect R			
	R0	2.622		2.778	2.700
R × N	R1	2.711		2.800	2.756
	R2	3.333		3.533	3.433
LSD			0.1780		0.1259
Effect N		2.889		3.037	
LSD			0.1028		

Dry matter of the shoot (%)

Results of Table (5) show that there were significant differences on Dry matter of the shoot for treatment F2 which it gave the highest rate 53.22 g compared to treatment F0 which gave the lowest rate 47.14 g, with an increase 12.89%. We also notice that the root stimulator had a significant effect on Dry matter of the shoot for treatment R2 which it gave the highest rate 54.67 g compared to treatment R0 ,which reached 48.28 g, with an increase rate of 13.23% .The results in the table indicate that spraying with Nano-fertilizer had a significant differences on Dry matter of the shoot, reaching 50.96 g in treatment N1 compared to treatment N0, which gave the lowest rate 48.59 g , with an increase of 4.87%.

The effect of the interaction of this study factors, showed a significant value between fertilization with NPK and root stimulator, which the treatment F2R2 gave the highest rate of stem diameter increasing, reaching 57.50 g , compared to treatment F0R0, which it gave the lowest rate 45.17g . The interaction of this study factors, showed a significant value between NPK fertilization and Nano-fertilizer, the treatment F2N1 gave the highest rate in the same trait, and it reached 54.56 g ,while F0N0 treatment gave the lowest rate of 46.00 g. The results showed in the same table significant value of the interaction between the root stimulator and the Nano-fertilizer the treatment R2N1 recorded the highest rate of Dry matter of the shoot increase 56.00 g compared to the treatment R0N0, which recorded the lowest rate of 46.78 g . As for the triple interaction, the results indicate that treatment F2R2N1 gave the highest rate of Dry matter of the shoot 58.33 g , compared to the control treatment F0R0N0, which gave the lowest rate 44.00 gr The increase in dry weight of the vegetative parts of the seedlings may be attributed to the nitrogen content in added fertilizers, which plays an important role in activating meristems, cell division, as well as in the formation of nucleic acids and activation of enzymes. This leads to a positive development in the green characteristics. The increase in dry

mass of the vegetative of the seedlings may also be attributed to the increase in chlorophyll in the leaves, which means an increase in metabolic processes and the synthesis of carbohydrate materials. This increase is reflected in the dry weight of the seedlings. These results are in agreement with Al-Rubaie et al. (8) for orange, olive, and lemon plants.

Table 5. Effect of NPK, root stimulator and spraying with Nano-micronutrients on Dry matter of the shoot (%) of citrus rootstock seedlings Rangpur

(F) effect of NPK	Effect of root stimulator	The effect of Nano fertilizer N0 (without addition)	N1 (1g L-1)	FxR
F0 (without addition)	(zero)R0	44.00	46.33	45.17
	R1 5 ml L^{-1}	44.00	45.33	44.67
	R2 10 ml L^{-1}	50.00	53.33	51.67
F1(2 gm $seedling^{-1}$)	R0	46.33	49.00	47.67
	R1	44.00	44.67	44.33
	R2	53.33	56.33	54.83
F2(4 gm $seedling^{-1}$)	R0	50.00	54.00	52.00
	R1	49.00	51.33	50.17
	R2	56.67	58.33	57.50
LSD		4.001		2.829
		Effect F		
F × N	F0	46.00	48.33	47.14
	F1	47.89	50.00	48.94
	F2	51.89	54.56	53.22
LSD		2.310		1.633
		Effect R		
R × N	R0	46.78	49.78	48.28
	R1	45.67	47.11	46.39
	R2	53.33	56.00	54.67
LSD		2.310		1.633
Effect N		48.59	50.96	
LSD		1.334		

Leaves chlorophyll content (mg g^{-1} fresh weigh) Results of Table (6) show that there were significant differences on Leaves chlorophyll content for treatment F2 which it gave the highest rate 2.37 mg gm^{-1} compared to treatment F0 which gave the lowest rate 1.88 mg gm^{-1}, with an increase 26.06%. We also notice that the root stimulator had a significant effect on Leaves chlorophyll content t for treatment R2 which it gave the highest rate 2.33 mg GM-1 compared to treatment R0 ,which reached 1.96 mg gm^{-1} , with an increase rate of 18.87%. .The results in the table indicate that spraying with Nano-fertilizer had a significant differences on Leaves chlorophyll content, reaching 2.29 mg gm^{-1} in treatment N1 compared to treatment N0,

which gave the lowest rate 2.01 mg gm^{-1} , with an increase of 13.93%The effect of the interaction of this study factors, showed a significant value between fertilization with NPK and root stimulator, which the treatment F2R2 gave the highest rate of Leaves chlorophyll content, reaching 2.56 mg gm^{-1}, compared to treatment F0R0, which it gave the lowest rate 1.75 mg gm-^{1}. The interaction of this study factors, showed a significant value between NPK fertilization and Nano-fertilizer, the treatment F2N1 gave the highest rate in the same trait, and it reached 2.52 mg gm^{-1},while F0N0 treatment gave the lowest rate of 1.78 mg gm^{-1}. The results showed in the same table significant value of the interaction between the root stimulator and the Nano-fertilizer the treatment R2N1 recorded the highest rate of Leaves chlorophyll content 2.468 mg gm^{-1} compared to the treatment R0N0, which recorded the lowest rate of 1.787 mg gm^{-1}. As for the triple interaction, the results indicate that treatment F2R2N1 gave the highest rate of Leaves chlorophyll content 2.67 mg gm^{-1}, compared to the control treatment F0R0N0, which gave the lowest rate 1.69 mg gm^{-1}. The high content of chlorophyll in leaves may be attributed to the direct addition of NPK fertilizers and root stimulants containing high concentrations of phosphorus, as well as the use of nano-spray with trace elements. Providing seedlings with the necessary nutrients through fertilization also increases the content of these elements in the leaves, thereby improving growth. These scientific research conducted by Al-Alaf and Shiyal (1).

Table 6. Effect of NPK, root stimulator and spraying with Nano-micronutrients on Leaves chlorophyll content (mg g^{-1} fresh weigh) of citrus rootstock seedlings Rangpur

(F) effect of NPK	Effect of root stimulator	The effect of Nano fertilizer N0 (without addition)	N1 (1g L-1)	FxR
F0 (without addition)	(zero)R0	1.69	1.82	1.75
	R1 5 ml L^{-1}	1.78	1.99	1.88
	R2 10 ml L^{-1}	1.87	2.14	2.00
F1(2 gm $seedling^{-1}$)	R0	1.75	2.21	1.98
	R1	2.06	2.34	2.20
	R2	2.27	2.59	2.43
F2(4 gm $seedling^{-1}$)	R0	1.92	2.39	2.15
	R1	2.31	2.51	2.41
	R2	2.46	2.67	2.56
LSD		0.011		0.007
		Effect F		
F × N	F0	1.78	1.98	1.88
	F1	2.03	2.38	2.20
	F2	2.23	2.52	2.37
LSD		0.006		0.004
		Effect R		

	R0	1.78	2.14	1.96
R × N	R1	2.05	2.28	2.16
	R2	2.20	2.46	2.33
LSD		0.006		0.004
Effect N		2.01	2.29	
LSD		0.003		

Conflict of interest

The authors have no conflict of interest.

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