Comparison Effects of Soil and Foliar NPK Fertilizers Applications with Various Times on Growth of Rosa Plant (*Rosa hybrida* L.)

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ABSTRACT

This experiment was conducted in greenhouse during the 2018-2019 growing season at Horticulture and landscape design department, Technical Institute of Bakrajo, Sulaimani Polytechnic University, Sulaimani, Kurdistan Region/ Iraq. The Rosa plants (*Rosa hybrida* L.) were used as a test plant .The main objective of the study was to determine the impact of two different ways of NPK (20:20:20) fertilizer applications (soil and foliar), and four different time with five replications per treatment on some of the plant's growth parameters; Height of plants (HP) cm, Number of Branch / Plant (NBP), Leave Number / Plant (LNP), Number of Flowers / Plant (NFP), Flower Diameters (FD) cm, Number of Buds Remaining (NBR), Number of Petals/Flower(NPF). The different fertilizer application had significant impacts on studied parameters over time, the addition of fertilizer through soil had positive growth impacts in compare with foliar one. However, the foliar application increased some plant growth characteristics like PH, NBP, NLP, and FD. As the NPK doses applied once / two weeks the plant morphological characteristic increased over the control. The best interaction among the Soil and Foliar fertilizer, and different time NPK application was a combination of the NPK applied directly from the soil once / two weeks.

1. Introduction

Roses plant are members of the Rosaceae family, the most essential horticultural family in the world, revered for their extremely good variety and more than a few floral traits for the duration of history. They are the world's most important decorative plants with a production price of about 25 billion Dollars [1].

Roses plant (*Rosa hybrida*. L.) generally are one of the most chronic ornamental plants in the world [2] , with Colombia, the largest rose-producing united states in Latin America, exported 59,499 tons of roses plant in 2009 [3]

Roses have been characterized with the aid of each qualitative and quantitative morphological characteristics such as shape, size, and the coloration of hips, petals, and sepals, inflorescence architecture, size of the prickles, pedicel and glandular hairs [4,5].

Roses are a necessary financial crop worldwide, cultivated for landscaping, necessary oils and cut flowers. Rose breeding vegetation provides a credible source for developing of new cultivars and special germplasm for gardens, essential oil extraction and cut-flower industry [6].

The role roses play in landscape decoration is huge with their use to decorate road sides, residential areas and public parks. In addition, garden roses supply creative value in the course of the developing season. Both reproductive and vegetative organs are vital in the improvement of an ornamental plant which is of super visible quality. Regardless the economic significance of roses relative to different ornamentals, they are of slight importance when compared to predominant food vegetation and for this reason much less nicely studied [7]

Fertilizer is one of the most quintessential elements that amplify plant blossoming. Generally, fertilizers are the most important sources of plant nutrient that can be introduced into the soil to provide its common productivity. The appiance of terrific fertilizers is recognized as a vital administration practices that can increase the vital growth and improvement of plants in both quantitatively and qualitatively aspect [8].

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As a result, the agricultural community typically uses chemical artificial fertilizers in unbalanced quantities; and this result in optimum output yield could not be achieved. Furthermore, noticed that most of farmers in general only they use urea as chemical fertilizer beyond the addition of phosphate and potash fertilizers. Therefore, maintaining a legitimate nutritional balance can play a critical role in promoting a sustainable farming system in agriculture [9]

One of the most vital elements in maintaining top yields of vegetation is nitrogen [10]. Nitrogen promotes shoot improvement and bud break in rose plants [11]. The Nitrogen element is provided in excessive concentrations (150–200 ppm) in fertigation packages of rose crops[11]. Nitrogen, phosphorus, and potassium (NPK) are the essential soil nutrients required for all plant growth [13,14,15,16]. In proper fertilization strategies, N is frequently applied in increased portions than wanted to assurance a correct yield crop [12].

In a previous study, notable effects of chemical fertilizer application were determined while the effects of low N, P and K feeding on plants cause lower photosynthetic levels and slower extension of the leaves [17, 18]. The purpose of this study was to clarify the influence of two ways (Soil and Foliar) of fertilizer (NPK) application, with different time on some morphological characteristic of rose plant.

2. Methods and Materials

The present research study was accomplished during growing season 2018-2019 under greenhouse circumstance in the Horticulture and landscape design department, Technical Institute of Bakrajo, Sulaimani Polytechnic University, Sulaimani, Kurdistan region/Iraq. The effect of different dosage of fertilizer Soil and Foliar application on Rosa plant growth was tested using 15 gm NPK (20:20:20), different time of fertilizer application. To prepare the extraction for foliar application was dissolved 15 gm NPK (20:20:20) in one liter of distilled water ,the concentration of extraction 15gm/ liter.

2. 1 *Treatments*

The fertilizer application was maintained per pots by (soil) and (foliar) to compare with four various time. The following treatments were appointed; control (T0) not fertilizer was applied, (T1) Once / week, (T2) once / two weeks and (T3) once / three weeks.

2. 2 *Soil*

The soil used in the study was collected from Technical Institute of Bakrajo field, which was analyzed the physical and chemical properties from [19]. The soil was slightly alkaline in reaction, which contained low organic matter, low available Zn and P content, low alkaline pH, plant available K was also not at an adequate level, also high available the amounts of Ca and Mg (Table 1).

Table 1: The properties of the soil

	pH	EC	CaCO3	Organic Matter	Ca	Mg	K	P	Zn	Mn
		(Millimhos /Centimeter)		(%)		(ppm or mg kg⁻¹)				
soil	7.65	2.0	2.45	2.30	4521	223.2	203	4.07	1.43	27.2

2. 3 *Pots preparation*

The pots diameter and depth used in the study was (20, 17)cm respectively, and filled by 2.5 kg soil for each pots and contains one plant per treatments. Rosa saplings were selected based on their age and size (one year old and uniform size). Then, the saplings were transplanted into pots. All planted pots were irrigated uniformly and on a "as needed" basis, depending on the environmental condition and soil moisture. Watering frequency ranged from Once / week from the beginning of the experiment, when the plants were small to three times a week at the end of the experiment (because the mature plant needs more water).

2. 4 Morphological Characteristic

The biomass was harvested 5 months after plantin to find the morphological characteristic such as; Plant Height (PH) cm, Number of Branches / Plant (NBP), Number of Leaves / Plant (NLP), Number of Flowers / Plant (NFP), Flower Diameters (FD) cm, Number of Buds Remaining (NBR), Number of Petals/Flower(NPF)

2. 5 Statistical Analysis

A factorial experiment (2×4×5) in randomized complete block design (RCBD) with five replications was used in this research to test interaction and main effects of fertilizer application was maintained per pots by soil) and foliar to comparation and four various time. In order to achieve this goal, analysis of variance (Two way ANOVA) was applied to the data using xlstat software 2020 Advanced Statistics version 2020.1 software [20]. The LSD Multiple Comparison test was used in this program for the key effects of treatments that varied when the F-value was important at $p \leq 0.05$.When means were significantly different, letters were assigned to identify different groups. When the same letters are not different significantly when the means within a columns.

3. Results and Discussion

The results of analysis of variance (ANOVA) for the application of different ways (foliar and soil) of fertilizer (NPK), different time of fertilizer application (Once / week, once /two weeks, and once/ three weeks) and their interactions with regard to some morphological characteristic of Rosa plant measured are given in (Table 2).

Table 2: The results of the ANOVA treatments and their interactions for the growth of morphological characteristic of the Rosa plant.

Parameters		Plant Height (cm)	No. branches/ plant	No. leaves /plant	No. Flowers/ plant	Flower diameters (cm)	No. Buds remaining	No. Petals/Flower
Source	*D.F*	*P>F*	*P>F*	*P>F*	*P>F*	*P>F*	*P>F*	*P>F*
Different ways (Soil and Foliar)	1	0.832	0.150	0.000	0.002	0.000	0.016	0.000
various Time	3	0.001	0.015	0.000	0.000	0.000	0.011	0.000
Interaction	3	0.717	0.180	0.001	0.830	0.001	0.055	0.000

The measured morphological characteristic such as NLP, NFP, FD, NBR and NPF, with a few exceptions, significantly affected from the different fertilizer ways, different times of application except for PH and NBP. The interaction between the main effects did not affect PH, NBP, and NFP.

The effect of different fertilizer application (Soil, Foliar) on post-harvest measured morphological characteristic were compared LSD multiple comparison test (Table 3). the application of the fertilizer directly from the soil significantly increases all green part of Rosa plants expect NLP (139.70 b), FD (6.18 b). However, the pots treated by foliar application not significantly increased the NFD, NBR, and NPF, but the PH, and NBP statistically there was not differences between the fertilizer applications by soil and foliar. In this study the application of the fertilizer through soil had grater effect on growth Rosa plant in comparsion with foliar fertilizer, as some of the nutrients during the foliar application were lost from the air, hot, rate of evaporation and not homogenously applied from all sides of the plants, but directly add the NPK to the soil the roots of the plant absorb fertilizer form the soil solution. From this experiment it was observed that NPK (20:20:20) applied from the soil had a profound impact on increasing numbers of flowers. Ahmad et al (2010) [21] recorded that application of micronutrients followed by application of only Boron fertiliser gives early and increase flowering / plant as compared to other types of treatment. Compared to the control plan, there were 14 % more flowers produced with the application of nutrients [22]. The result of this study was comparable with Agarwal et al (2002) [23], which reported that foliar fertilizer with NPK was significantly increase in the some growth characteristic of rosa plant, compared to the NPK application alone and untreated plants.

Table 3: The effect of different fertilizer NPK application (Soil, Foliar) on measured morphological characteristic of the Rosa plant.

Fertilizer application	plant Height (cm)	No. branches /plant	No. lesves /plant	No. Flowers /plant	Flower diameters (cm)	No. Buds remaining	No. Petals/Flower
Soil	66.33 a	6.40 a	139.70 b	6.80 a	6.18 b	2.10 a	29.20 a
Foliar	66.15 a	7.05 a	187.65 a	5.50 b	7.35 a	1.45 b	24.50 b
LSD	**1.74**	**0.85**	**4.95**	**0.79**	**0.3**	**0.55**	**1.63**

*The same letters are not different significantly when the numbers within a columns awarded to (LSD, p < 0.05).

The effects of various time of NPK application on measured morphological characteristic of the Rosa plant statistically increased (Table 4). The NPK applications with (T3) increased PH (68.40 a cm) significantly compared to the control (T0) (64.70 b cm), but statistically there was not differences with (T2). The (T1) significantly only caused to increase NFP (31.50 a). However, all morphological characteristic significantly increased with (T2) compared to the control and other treatments. The results are agrred with Kumar et al (2017) [24] they reported the application of NPK (90:80:90) kg/ha^{-1} significantly increases the number of flowers as compared to control. So, various time applied of the fertilizers effects on plant growth with environmental conditions. Improvement of growth stages, such as plant height and leaf area by micronutrient usage, may be due to increased photosynthetic and other metabolic functions, which contributes to an boost in the amount of plant metabolites responsible for cell division and elongation [25].

In the Table 5 showed the interaction among the effect of different fertilizer way (Soil, Foliar) with various time of NPK application. The best interaction for increasing the value of PH was a combination of the soil and T3. The NFP (8.80 a) increased with foliar and Once / week. Finally, the best interaction in the study for increasing the NBP (9.00 a), NLP (203.20 a) ,FD (9.60 a),and NBR (2.60 a) was soil and once/ two weeks.

Table 4: The effects of various time of NPK application on measured morphological characteristic of the Rosa plant

Time of Fertilizer application	plant Height (cm)	No. branches /plant	No. lesves /plant	No. Flowers /plant	Flower diameters (cm)	No. Buds remaining	No. Petals/Flower
T0	64.70 b	5.90 b	151.80 c	3.00 c	4.80 d	1.20 b	19.10 c
T1	64.10 b	6.90 ab	160.50 b	7.90 a	8.15 b	1.50 b	31.50 a
T2	67.75 a	7.90 a	178.10 a	7.40 ab	8.75 a	2.40 a	30.50 a
T3	68.40 a	6.20 b	164.30 b	6.30 b	5.35 c	2.00 ab	26.30 b
LSD	**1.74**	**0.85**	**4.95**	**0.79**	**0.3**	**0.55**	**1.63**

*The conditions for fertilization have been set in per; control (T0) not fertilizer applied, (T1) Once / week, (T2) once two weeks and (T3) once / three weeks.

Table 5: The all interaction between the soil and foliar   NPK fertilizers application, and various time, in the experiment.

Fertilizer application	plant Height (cm)	No. branches /plant	No. lesves /plant	No. Flowers /plant	Flower diameters (cm)	No. Buds remaining	No. Petals/Flower
SOIL*T2	68.00 ab	9.00 a	203.20 a	7.00 bc	9.60 a	2.60 a	29.00 bc
FOLIAR*T2	67.51 abc	6.80 b	153.00 d	7.80 ab	7.90 b	2.20 ab	32.00 ab
FOLIAR*T1	63.80 c	6.60 b	137.60 e	8.80 a	7.10 c	2.00 ab	35.00 a
SOIL*T1	64.40 bc	7.20 b	183.40 b	7.00 bc	9.20 a	1.00 b	28.00 c
FOLIAR*T3	68.40 a	6.00 b	133.00 e	7.00 bc	5.20 d	2.80 a	31.60 ab
SOIL*T3	68.40 a	6.40 b	195.60 a	5.60 c	5.50 d	1.20 b	21.00 d
FOLIAR*T0	65.60 abc	6.20 b	135.20 e	3.60 d	4.50 e	1.40 b	18.20 d
SOIL*T0	63.80 c	5.60 b	168.40 c	2.40 d	5.10 de	1.00 b	20.00 d
LSD	**3.48**	**1.71**	**9.9**	**1.58**	**0.6**	**1.09**	**3.62**

* The same letters are not different significantly when the numbers within a columns awarded to (LSD, $p < 0.05$).

4. Conclusion

Our goal was to evaluate the impact of the application of different ways (foliar and soil) fertilizer (NPK), different time of fertilizer application (control no fertilizer, Once / week, once 2 weeks, and once 3 weeks). Fertilizer applications had grater effect on Rosa plant were used directly with soil compared with foliar way and increased all of the morphological characteristic. In accord with foliar way, NPK applications decreased NFP, NBR, and NPF, and at the same time PH, NBP, NLP, and FD increased. During this experiment the different   time of fertilizer application had the greatest effect on Rosa plant especially once in 2 weeks compared with the other times. Finally, many reports of increased green parts of Rosa plant with NPK have been conducted in greenhouses conditions. Since these studies are under ideal growing conditions, the effects of NPK can vary under field conditions where there is a complex interaction among soil, environment and other factors. Consequently, the findings of the greenhouse experiments could not be repeated when similar studies are performed under field conditions.

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