



## Effects of different fertilizer combinations on sapling morphology, biomass and growing media characteristics of *Rosa meiland* Christof Colomb

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### ABSTRACT

*Background and Aims* A fertilizer combination containing five different fertilizers plus Osmocote was tested at different concentrations in the growing media of *Rosa meiland* Christof Colomb saplings. Morphological traits, physicochemical properties of the mixtures, leaf nutrient contents, and changes in moisture values (leaf and flower) were investigated.

*Methods* Each mixture included 12 saplings with three replicates (total: 144 saplings). Weekly measurements were taken for 16 weeks to determine leaf length and diameter, number and length of shoots, flower diameter and number, and sapling diameter. Physical properties (sand, silt, clay) and macro- and micronutrient contents of the growing media were analyzed. One-way ANOVA was used to compare treatments.

*Results* Although some weekly morphological measurements differed significantly, no consistent trend was observed. In cumulative comparisons (16 weeks), only flower diameter differed significantly among mixtures, while leaf nutrients and both flower and leaf biomass did not. Among physicochemical properties, water saturation, Nt, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, Cu, Fe, Mn, and Zn differed significantly between mixtures. Leaf moisture values also showed significant differences.

*Conclusion* Overall, the lowest values were generally found in mixture4 (80% peat, 10% river sediment + 10% pumice stone + fertilizer combination), which used only the fertilizer combination.

**Key Words:** Biomass component, flower, macro nutrient, micro nutrient, osmocote

### Research Article

## Farklı gübre kombinasyonlarının *Rosa meiland* Christof Colomb fidan morfolojisi, biyokütle ve yetiştirme ortamı üzerine etkileri

### ÖZ

*Giriş ve Hedefler* Beş farklı gübre + Osmocote içeren bir gübre kombinasyonu, *Rosa meiland* Christof Colomb fidanlarının yetiştirme ortamında farklı dozlarda denenmiştir. Yaprak ve çiçek biyokütlesi gibi morfolojik fidan özellikleri, karışımların fiziko-kimyasal özellikleri, yaprak besin element analizleri ve (yaprak ve çiçek) nem değerlerindeki değişimler incelenmiştir.

*Yöntemler* Her karışımda 12 fidan ve üç tekerrür kullanılmış (toplam 144 fidan) ve 16 hafta boyunca haftalık ölçümler yapılmıştır. Yaprak uzunluğu ve çapı, sürgün sayısı ve uzunluğu, çiçek çapı ve sayısı ile fidan çapı belirlenmiştir. Yetiştirme ortamında fiziksel özellikler (kum, toz, kil) ile makro ve mikro besin elementleri analiz edilmiştir. Sonuçların karşılaştırılmasında tek yönlü varyans analizi (ANOVA) kullanılmıştır.

*Bulgular* Haftalık değerlendirmelerde bazı morfolojik özelliklerde anlamlı farklılıklar görüldü de belirgin bir eğilim saptanmamıştır. Kümülatif (16 hafta toplamı) karşılaştırmada yalnızca çiçek çapı karışımlar arasında anlamlı farklılık göstermiş; yaprak besin elementleri ile çiçek ve yaprak biyokütlesi anlamlı düzeyde değişmemiştir. Fiziko-kimyasal özelliklerde suya doygunluk, Nt, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, Cu, Fe, Mn ve Zn değerleri karışımlar arasında anlamlı farklılık göstermiştir. Yaprak nem değerleri de karışımlara göre anlamlı düzeyde değişmiştir.

*Sonuçlar* Genel olarak en düşük değerler, yalnızca gübre kombinasyonunun kullanıldığı 4. karışımda (%80 torf, %10 dere sedimenti + %10 pomza + gübre) belirlenmiştir.

**Anahtar Kelimeler:** Biyokütle unsuru, çiçek, makro besin maddesi, mikro besin maddesi, osmocote

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## 1. Introduction

Rose (*Rosa* sp.), a member of the *Rosaceae* genus, grows naturally in the Northern Hemisphere with its many species distributing over many continents. Furthermore, millions of roses are cultivated in parks and gardens every year both globally and in Türkiye, while billions of cut flower roses are traded in pots and greenhouses (Karagüzel et al. 2014). Furthermore, as Özçelik (2014) points out, roses have been used throughout history for cultural, literary, artistic, spiritual, landscape, medicinal, aromatic, food, and dye purposes.

Roses are among the most prominent plants in parks, gardens, and landscaping applications. They grow their roots well and can survive for many years. Their flower size, number, and visual richness, as well as their branching and branching structure, can be quite diverse. With a history of preference and use as old as human history, they are now the most widely used cultivated plant worldwide for cut flower production, various other sectors, and for harvesting (Khabbazi and Yazgan 2013).

Roses cannot be grown in every soil condition to achieve high production and yield. They generally prefer soils with good moisture retention, a loamy texture, and rich organic matter. Physically, these soils are not very sticky when moist, but they crumble quickly when dry and are easily workable. Extreme soils, such as clay, sandy, or calcareous soils, make growing and yielding difficult. Extreme soils can pose negative risks such as pest infestation, root and stem rot and diseases, poor growth, and poor flowering. Roses are difficult to grow in gley, pseudogley and saline or acid soils, swampy soils with high organic matter (Khabbazi and Yazgan, 2013). Depending on all these, considering that different roses may have different growing media preferences, the selection of materials to be used as plant growth medium in ornamental plant cultivation and the selection and creation of suitable fertile growing place materials have the potential to provide multifaceted benefits (Kılıç 2018) and these should be tried.

Currently, many different additives and mixtures are being tested not only for rose growing but also for plant growth. Naturally derived organic matters, various inorganic substances, fertilizers, and many other additives are being used and tested in seedling-plant growing mixtures (Aygün and Özenç, 2023; Çığ and Gülser 2023; Etem and Türkmen 2023; Tandoğan et al., 2023; Ağaç et al., 2024; Kara et al., 2024).

Growing media mixtures are prepared for purposes such as improving the growing media or making it more fertile, increasing its nutritional power, and increasing plant water use efficiency (Kantarci, 2000).

Based on all these explanations, this study is a pilot project investigating the effects of fertilizer mixtures applied to potted *Rosa meiland* Christof Kolomb seedlings. The study investigated the effects of different doses of Osmocote exact, a standard fertilizer used in nurseries, and alternatively selected combined fertilizer mixtures on some seedling growth characteristics. The fertilizers' combinations consisted of five different fertilizers. The names of five fertilizers are not given in the manuscript to avoid commercial and advertising misunderstandings. In addition to their effects on some morphological and biomass characteristics of the saplings, leaf chemical properties, and physicochemical analyses of the mixtures were also evaluated.

## 2. Materials and Methods

### 2.1 Research area and experiments

Istanbul AĞAÇ A.Ş. Istanbul Alibeyköy Nursery is among Türkiye's largest nurseries, and it has a significant role in the sectors of ornamental plant growing. Specializing in the production and sale of potted saplings, the nursery has high-quality tree, shrub, and small shrub saplings (Çakıroğlu 2024). Annual mean temperature for Alibeyköy is 14.4 °C, February is the coldest month with 5.5°C and the warmest month (July) 23.9°C (Özdemir, 2007). Data from the Florya Meteorological Station indicate that precipitation begins in October and continues throughout the winter season, extending into May. However, there is a dry period during June - August, with an average annual precipitation of around 672 mm (Özdemir, 2007).

The experiment used a 15x15x24 cm, 4.4 L, black, plastic, square pot, and a *Rosa meiland* Christof Columbus rose grafted on "LAXA" of *Rosa Corymbifera* saplings (1+1-year-old). Four different potting mixes as growing media were prepared for the planting.

The Fertilizer Combination was created by mixing five different fertilizer products. Since commercial names cannot be given, these five fertilizers are listed by number. These are:

Fertilizer 1: Found in living algae cells. Increases chlorophyll synthesis, 500ml/10lt water. Fertilizer 2: A bacterial complex. Accelerates of the organic matter decomposition and the uptake of fertilizers by plants, 20ml/10lt water. Fertilizer 3: It is an instant effective balanced development fertilizer containing NPK + micro elements. It ensures the compact development of the plant, 20ml/10lt. Fertilizer 4: A blend of organic fertilizer + vitamins + enzymes. Encourages new capillary root formation, 50ml/10lt. Fertilizer 5: It is an instant-acting root fertilizer containing NPK + microelements. It encourages rooting in plants, 50ml/10lt.

#### Experiment of Growing Media Mixtures

Mixture1 : 80% peat+ 10% river sediment+ 10% pumice stone + 5 kg/m<sup>3</sup> Osmocote.

Mixture2: 80% peat + 10% river sediment + 10% pumice stone +5 kg/m<sup>3</sup> Osmocote, + fertilizer combination.

Mixture3: 80% peat + 10% river sediment + 10% pumice stone + 2.5 kg/m<sup>3</sup> Osmocote, + fertilizer combination.

Mixture 4: 80% peat, 10% river sediment + 10% pumice stone + fertilizer combination.

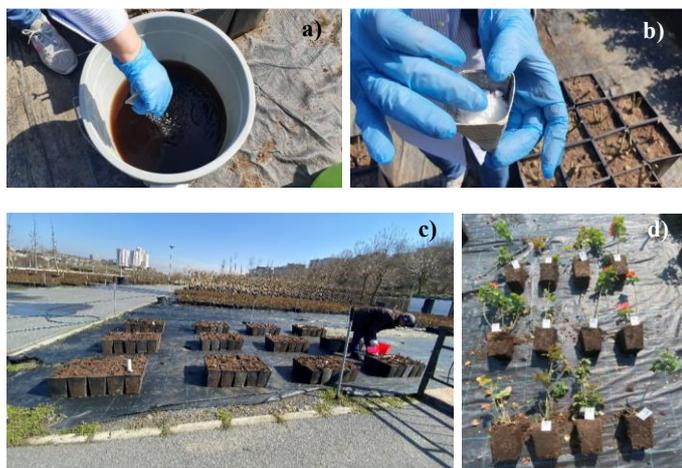
In summary,

1. 5 kg/m<sup>3</sup> of Osmocote fertilizer was added to the first pot mix.
2. 5 kg/m<sup>3</sup> of Osmocote fertilizer and the fertilizer combination were added to the second pot mix.
3. 2.5 kg/m<sup>3</sup> of Osmocote fertilizer and the fertilizer combination were added to the third pot mix.
4. Only the fertilizer combination was applied to the fourth pot mix.

Fertilizer combination 3+4+5 was applied with irrigation water 3 times at 1-week intervals, and after the leaves matured, fertilizer combination 1+2+3 was applied with a foliar pulverizer 3 times at 1-week intervals.

The Osmocote Exact fertilizer used in the experiment contains nitrogen, phosphorus and potassium (15-9-11 + 2MgO + TE) with the plant trace elements and magnesium. The rates of elements total nitrogen (Nt): 15%, phosphorus pentoxide (P<sub>2</sub>O<sub>5</sub>): 9%, potassium oxide (K<sub>2</sub>O): 11%, and magnesium oxide (MgO): 2.0%. It is a slow-release fertilizer effective for 8-9 months.

Sapling experiment units with 12 seedlings were created in three replicates and arranged in different lanes for four different mixtures of growing media. Thus, the measured number of saplings was 3x12x4=144. The study included weekly measurements of flower diameter, leaf length, leaf diameter, plant height, shoot height (in 1mm sensitivity), flower number and shoot number. These measurements were taken weekly for a total of 16 weeks from the beginning of March (Figure 1).



**Figure 1.** Fertilizer combination experiment in *Rosa meilland* Christof Colomb. a) mixture of different fertilizer, b) preparing of powder fertilizer before mixing, c) set of experiment pots, d) measurement of selected saplings

All analyses, including the additives in the mixtures, were conducted at the TÜRKAK (Turkish Accreditation Agency) accredited R&D laboratory of AĞAÇ A.Ş. located at the Alibeyköy campus. OM, OrgC, pH, EC, salt, water holding capacity, CaCO<sub>3</sub>, texture type (silt, clay and sand) analyses were done for experiment mixtures. Nutrients' determinations

conducted in growing media mixtures included Nt, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, Mg, Ca, Na, Mn, Fe, Cu and Zn. The analysis methods used for these parameters are: Sand, silt, and clay and texture type: Bouyoucos hydrometer method, salt ratio, pH and EC (electrical conductivity) in solutions prepared with deionized water, water saturation: soil moisture difference between saturated and dry (105 °C) sample weight, soil organic matter and organic C: loss on ignition (550 °C), lime: with Scheibler calcimeter, total nitrogen (Nt): with Kjeldhal method, P<sub>2</sub>O<sub>5</sub> (phosphorus), Mg (magnesium), Ca (calcium), K<sub>2</sub>O (potassium), Na (sodium), Zn (zinc), Cu (copper), Mn (manganese) and Fe (iron) were analyzed in solutions prepared with ascorbic acid using an ICP-OES (Perkin Elmer) analyser (Çakıroğlu, 2024; Sukas et al. 2025). All biomass samples were first weighed in the field for fresh weight, and the subsamples were then dried at 70°C. Moisture values were calculated from the fresh and dry weights, and dry weight values were evaluated (Çakıroğlu, 2024).

Statistical analysis was performed using SPSS (IBM SPSS, 2010) computer software. In the statistical comparison of the values determined in the mixtures with the weekly measurements per week, ANOVA (analysis of variance) in the significance with P= 0.05 was used. Duncan's multiple range test was applied as a post-hoc analysis to determine significant differences among the treatment means.

### 3. Results and Discussion

Among the measured saplings characteristics, only flower diameter was significantly different in terms of average values, with the lowest value of 3.12 cm in mixture 4, separated from the other mixtures with a flower diameter of approximately 4 cm (Table 1). In weekly assessments, average leaf length across the mixtures over the experiment period was found to be within a range of around 10 cm. Average leaf diameter values ranged from 8 to 9 cm, the average number of shoots averaged five across all mixtures, average shoot length ranged from 25 to 27 cm, plant height ranged from 37 to 40 cm, and the average number of flowers throughout the experiment was around 0.5 due to the many weeks without flowers (Figure 2). These characteristics listed above did not differ significantly among the mixtures in terms of overall average values from the 16-week measurements (Table 1).

**Table1.** Average values of total 16 weeks of rose sapling characteristics

Parameters	Mixture1	Mixture2	Mixture3	Mixture4	P
Leaf length (cm)	10.14±0.13a	10.32±0.17a	10.42±0.12a	10.18±0.14a	0.486
Leaf diameter (cm)	8.50±0.11a	9.13±0.57a	8.65±0.10a	8.37±0.11a	0.307
Shoot number (n)	5.09±0.14a	5.30±0.12a	5.20±0.14a	5.19±0.17a	0.787
Shoot length (cm)	25.92±0.61a	25.26±0.56a	27.09±0.68a	25.77±0.63a	0.210
Plant height (cm)	36.69±1.04a	39.35±1.32a	40.80±1.14a	37.96±1.22a	0.085
Flower diameter (cm)	4.43±0.40b	4.82±0.41b	4.13±0.40ab	3.12±0.38a	0.021
Flower number (n)	0.60±0.06a	0.61±0.05a	0.56±0.06a	0.47±0.07a	0.463

± standard error, different letters in the rows indicates values are different significantly, n=144

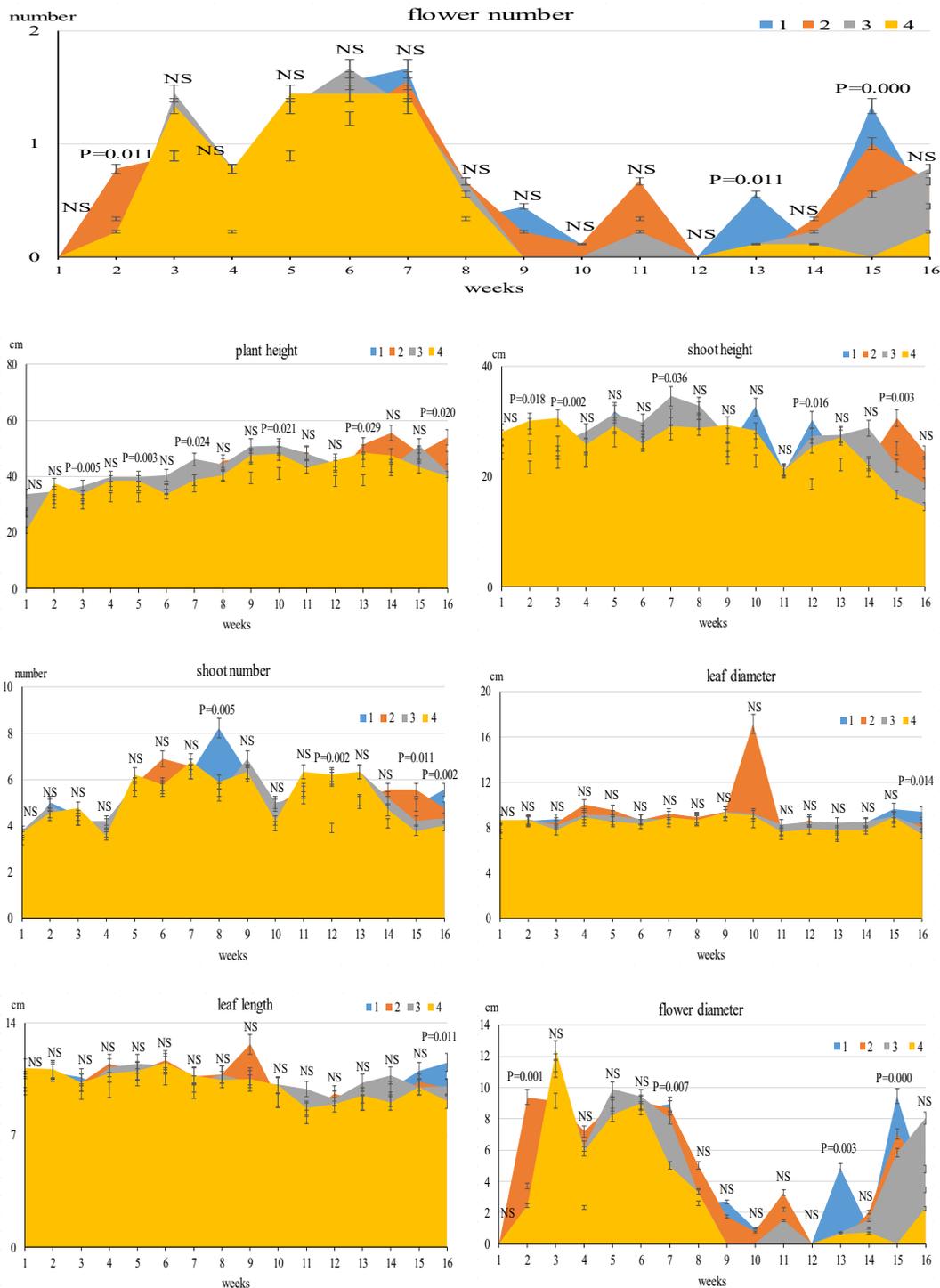


Figure 2. Weekly evaluations of rose sapling morphology

The analysis results of the prepared growing media mixtures revealed significant differences in water saturation, nitrogen, phosphorus, potassium, copper, iron, manganese, and zinc values (Table 2). Post hoc tests performed on these properties revealed significant differences, with mixture1 having the lowest water saturation values compared to the others, while mixture4 had the lowest nitrogen, phosphorus, and copper values. Mixture4 and mixture3 also differed with the lowest iron and manganese content. Mixture3 was distinguished by the lowest zinc concentration, whereas mixture2 exhibited the highest potassium levels. Although it is difficult to establish a

distinct pattern, mixture4 generally demonstrated significantly lower values compared to the other groups. However, in this comparison, although there is a significant difference between the mixtures for some nutrients in bold on Table2, it is seen that all nutrients are above the limit values and sufficient for plant nutrition (Padem 2007; Çakıroğlu 2024) (Table 2).

The availability of plant nutrients in plant organs is important for photosynthesis and nutrient cycling. When mixtures were compared for leaf values of macro- and micronutrients, no significant differences were determined (Table 3). When leaf nutrients were compared with the reference

values given by Bolat and Kara (2017), all nutrients were at sufficient values (Bolat and Kara 2017) for the plants. Although copper was shown as the limit value of 6 ppm in Bolat and Kara (2017), it was below 6 ppm in all mixtures. Similar results were also obtained in the biomass and nutrient analyses of Anatolian Sweetgum (*Liquidambar orientalis*) saplings conducted in the same nursery (Ağaç A.Ş. Alibeyköy Nursery), and Cu values in the leaf biomass component of many seedling samples in the experiment were determined below the 6 ppm threshold value (Çakıroğlu 2024).

Bolat and Kara (2017) reported that copper deficiency can be observed in rich organic matter soils and in peat soils (peat soils containing 50-80% organic matter) due to the strong bounding of copper by organic matter. Although not observed in this study, copper deficiency can lead to symptoms such as chlorosis (discoloration) in young leaves, low growth, delayed senescence, and in some cases, excess pigmentation in tissues (brown stain), increased susceptibility to fungal diseases, and decreased carbohydrate content (Boşgelmez et al., 2001; McCauley et al., 2009; Kacar and Katkat, 2010; Çakıroğlu 2024). When the chemical analysis results of the growing media

mixtures are evaluated in general, it can be interpreted that the lowest values were found in mixture4, which included only the fertilizer combination, and the highest values were found in mixture1, which included only the Osmocote fertilizer. However, as repeatedly mentioned above, no significant differences of leaf nutrients were determined among mixtures (Table 3).

No significant differences were detected between the mixtures in terms of flower biomass, leaf biomass, and flower biomass/leaf biomass ratios (Table 4). Moisture rates determined in flower samples did not differ significantly between the mixtures, while leaf moisture differed significantly, with mixture4 having the lowest moisture values in leaves (Table 4). Although mixture4 had the highest water saturation values in soil analyses, the presence of the lowest moisture values in leaves suggests a difference in plant water use efficiency. However, since only a single sampling was taken and the experiment was irrigated regularly according to the irrigation program scheduled in the nursery, this difference can be interpreted as a temporal difference (Table 4).

**Table 2.** Some physical and chemical analysis results of rose growing media

Characteristics	Mixture1	Mixture2	Mixture3	Mixture4	P
Sand (%)	73.96±1.53a	74.33±1.61a	73.37±0.63a	74.91±0.66a	0.897
Clay (%)	7.19±0.64a	6.44±0.56a	6.56±0.71a	6.88±0.82a	0.843
Silt (%)	18.83±1.09a	19.72±1.25a	20.06±0.48a	18.21±0.31a	0.609
pH	6.66±0.10a	6.49±0.06a	6.73±0.13a	7.31±0.48a	0.128
EC (µmhos/cm)	805.00±269.03a	648.25±271.69a	703.33±211.33a	636.80±183.08a	0.958
Salt (%)	0.11±0.04a	0.11±0.04a	0.12±0.04a	0.10±0.04a	0.999
WS (%)	<b>211.47±7.45a</b>	<b>259.42±3.51b</b>	<b>238.33±18.34ab</b>	<b>271.86±22.63b</b>	<b>0.034</b>
OM (%)	25.69±0.44a	29.42±0.76a	27.45±2.23a	26.32±2.35a	0.288
Lime (%)	2.32±0.91a	2.10±0.72a	2.86±0.38a	2.74±0.47a	0.870
Nt (%)	<b>0.571±0.034b</b>	<b>0.621±0.017b</b>	<b>0.582±0.017b</b>	<b>0.425±0.065a</b>	<b>0.020</b>
P <sub>2</sub> O <sub>5</sub> (kg/da)	<b>55.09±6.44b</b>	<b>62.17±4.11b</b>	<b>49.22±4.27ab</b>	<b>37.44±1.68a</b>	<b>0.031</b>
K <sub>2</sub> O (kg/da)	<b>56.33±4.90a</b>	<b>70.57±5.56b</b>	<b>47.71±0.41a</b>	<b>48.53±0.51a</b>	<b>0.013</b>
Ca (mg/kg)	12702.5±316.4a	13990.0±111.6a	13637.9±402.5a	13784.5±663.6a	0.114
Mg (mg/kg)	761.57±16.87a	758.85±5.73a	761.99±60.91a	736.24±14.39a	0.911
Na (mg/kg)	121.57±5.74a	123.70±3.76a	119.37±5.78a	112.32±11.20a	0.672
Cu (mg/kg)	<b>4.43±0.58c</b>	<b>4.12±0.22c</b>	<b>2.14±0.54b</b>	<b>0.68±0.05a</b>	<b>0.000</b>
Fe (mg/kg)	<b>89.09±1.11b</b>	<b>92.59±1.48b</b>	<b>59.26±0.44a</b>	<b>59.71±1.61a</b>	<b>0.000</b>
Mn (mg/kg)	<b>17.79±1.22b</b>	<b>16.82±0.48b</b>	<b>12.40±0.60a</b>	<b>12.59±0.75a</b>	<b>0.002</b>
Zn (mg/l)	<b>10.70±0.45b</b>	<b>10.66±0.28b</b>	<b>7.41±0.54a</b>	<b>9.54±0.97b</b>	<b>0.008</b>

WS: water saturation, OM: organic matter, EC:electrical conductivity, ± standard error, different letters in the rows indicates values are different significantly

**Table 3.** Comparison of chemical analysis results of rose leaves

Characteristics	Mixture1	Mixture2	Mixture3	Mixture4	P
N (%)	1.806±0.197a	2.045±0.279a	2.047±0.186a	1.451±0.091a	0.196
P (%)	0.219±0.022a	0.220±0.029a	0.220±0.012a	0.173±0.011a	0.337
K (%)	1.848±0.116a	1.861±0.149a	1.875±0.076a	1.538±0.036a	0.139
Ca (%)	0.210±0.030a	0.260±0.035a	0.231±0.034a	0.182±0.048a	0.547
Na (%)	0.033±0.006a	0.045±0.001a	0.039±0.016a	0.024±0.007a	0.598
Mg (%)	0.168±0.009a	0.167±0.007a	0.183±0.011a	0.161±0.003a	0.373
Fe (ppm)	140.70±15.14a	146.39±24.74a	142.76±31.55a	112.65±24.49a	0.761
Mn (ppm)	23.973±1.802a	27.020±3.897a	26.843±2.925a	19.553±3.040a	0.327
Zn (ppm)	36.660±7.614a	36.306±5.230a	41.780±6.778a	32.166±5.440a	0.767
Cu (ppm)	3.795±1.744a	2.358±0.783a	1.502±0.969a	0.050±0.001a	0.173

Element concentrations are total, ± standard error, columns with the same letter in same row are not statistically significantly different (P>0.05).

**Table 4.** Comparison of different biomass elements and moisture results of rose saplings

Characteristics	Mixture1	Mixture2	Mixture3	Mixture4	P
Flower Biomass (g)	11.798±1.073a	9.891±1.487a	16.328±2.909a	13.524±3.507a	0.358
Leaf Biomass (g)	20.101±0.319a	19.614±0.808a	21.983±0.847a	21.243±0.998a	0.212
Flower/Leaf	58.574±4.621a	51.244±9.938a	73.789±11.391a	64.756±17.578a	0.603
<b>Leaf moisture (%)</b>	<b>67.949±0.258b</b>	<b>68.948±0.708b</b>	<b>68.211±0.340b</b>	<b>65.598±0.668a</b>	<b>0.011</b>
Flower moisture (%)	84.568±1.358a	82.188±0.666a	83.484±1.474a	82.516±1.679a	0.616

Biomass weights are dry weight, ± standard error, columns with the same letter are not statistically significantly different (P>0.05).

Rose flowers had a moisture content of around 80%, while leaf moisture rates are around 60%, respectively, while no comparison has been made between plant organs. Moisture rates are higher in forest and tree biomass components (36-38%) than the data from Özdemir and Makineci (2019).

No significant trend was detected in seedling parameters (flower number, flower diameter, leaf diameter, leaf length, shoot number, shoot length, and plant diameter) in weekly evaluations in the research of Sukas et al. (2025) investigating effects of different growing media mixtures (sediment, pumice, imported-local peat, and osmocote) on similar rose saplings (*Rosa meilland*) in the same nursery (Ağaç AŞ Alibeyköy). Sukas et al. (2025), citing various references presented below, show that different results are obtained, especially in rose experiments using fertilizers. For example, Kılıç (2018) used wastewater sludge especially, also peat, forest soil, pumice, cocopeat, cattle manure, and compost for growing media mixture in the Kordes rose (Maxi vita) experiment in Konya. Measurements were made in 20 different plants growing media mixtures at six stages of flowering. The impacts on plant parameters such as flower diameter, bud number, plant height, color, petal and flower numbers were searched. Kılıç (2018) detected significant variations between the growing media and plant morphology on researched characters and recommended for practical use of recycled wastewater treatment sludge. Kural (2023) was carried out to investigate the usability of earthworm compost -vermicompost to test production and nutrition on oil rose - *Rosa damascena* site-specific to Isparta province in Türkiye. The results showed that vermicompost application increased rose flower yield, however, macro and micronutrient values in rose have not significantly differences. Singh (2006) reported that increased plant dry weight, leaf area index (LAI), and production in a rose kind (Gruss-an-Teplitz) in the experiment on combining an organic fertilizer in growing media. On the other hand, Bisht et al. (2013), searched the using vermicompost, cocopeat, and rice husks to effects on growing media, plant growth and flower characteristics in a "Grand Gala" rose variety. They reported that organic matter addition affected growth, flower number, and rose plant quality positively (Altunlu et al., 2018). Mortensen et al. (2001) investigated the variations of vegetative features on a variety of Parade Fiesta-miniature rose type under three different levels of air humidity and potassium (K)/calcium (Ca) ratios, their results showed that increased air humidity and a moderate ratio of K:Ca resulted in high numbers of bud and flower, increased height and specific leaf area, and reduced the root mass and the ratio of stem/root was increased.

Today, experiments with roses and various fertilizers continue in current research. For example, Hamedi et al., (2022), Liu et al., (2023), Abdel-Wahed et al. (2024), and Liu et al. (2025) have conducted research testing many different synthetic

and organic fertilizer types in the cultivation of different rose varieties.

#### 4. Conclusion

Based on all the evaluations, and considering ease of use and cost-effectiveness, it is recommended that future trials on roses conclude with a six-week evaluation. It was concluded that because the mixture and growing media provided a rich nutrient environment, the product combination and fertilizer use did not significantly impact plant growth. In summary, it is recommended that future studies utilize a comparison experiment without any fertilizer or product combination rather than assessing growth in the current growing media mixture.

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