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Research Article

The Effects of Cattle and Sheep Manure Applications on Soil Physical Properties and Rooting and Shoot Development of Grapevines Cuttings

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Abstract

In this study, the effects of cattle and sheep manure applications at different doses on soil physical properties, and in parallel with, the effects on rooting and shoot development of vine cuttings were investigated. In this study, 10%, 20% and 30% cattle and sheep manure was mixed into the soil as rooting medium, and the rooting and shooting performances of Karaerik and Narince grape varieties were evaluated in greenhouse conditions. During the experiment, the bud burst rates of the cuttings were recorded, and at the end of the experiment, the aggregate stability values, water permeability, bulk density, total porosity of the soil and plant parameters such as the root length, the root number, shoot length and the leaf number of the 1-year-old cuttings were determined. The highest root length values of Karaerik and Narince grape varieties were determined as 7.2 and 7.43 cm, respectively, in 20% sheep manure application. While the highest shoot length value (15.66 cm) in Karaerik grape cultivar was determined in 30% cattle manure application, the highest value (25.66 cm) in Narince grape cultivar was determined in 20% sheep manure application. As a result of the study, it was determined that sheep manure was more effective in root development and cattle manure in shoot development of Karaerik grape cultivar. It has been revealed that sheep manure gives more positive results on both root and shoot development than cattle manure in Narince grape cultivar.
Keywords: Grapevine cuttings, rooting and shooting, soil physics, farm manure

Sığır ve Koyun Gübresi Uygulamalarının Toprak Fiziksel Özellikleri ile Asma Çeliklerinin Köklenme ve Sürgün Gelişimi Üzerine Etkileri

Öz

Bu çalışmada, farklı dozlarda sığır ve koyun gübresi uygulamalarının toprağın fiziksel özelliklerine ve buna paralel olarak asma çeliklerinin köklenme ve sürgün gelişimine etkileri araştırılmıştır. Çalışmada köklendirme ortamı olarak toprağa %10, %20 ve %30 sığır ve koyun gübresi karıştırılarak Karaerik ve Narince üzüm çeşitlerinin sera koşullarında köklenme ve sürgün performansları değerlendirilmiştir. Deneme sırasında çeliklerin tomurcuk patlama oranları kaydedilmiş ve deneme sonunda toprağın agregat stabilitesi, su geçirgenliği, kütle yoğunluğu, toplam porozitesi ve bitki parametrelerinden bir yaşlı çeliklerin kök sayısı, kök uzunluğu, sürgün uzunluğu ve sürgündeki yaprak sayısı belirlenmiştir. Karaerik ve Narince üzüm çeşitlerinde en yüksek kök uzunluğu değerleri sırasıyla 7.2 ve 7.43 cm olarak 20% koyun gübresi uygulamasında tespit edilmiştir. Karaerik üzüm çeşidinde en yüksek sürgün uzunluğu değeri (15.66 cm) 30% sığır gübresi uygulamasında belirlenirken, Narince üzüm çeşidinde ise en yüksek değer (25.66 cm) 20% koyun gübresi uygulamasında tespit edilmiştir. Çalışma sonucunda Karaerik üzüm çeşidinin kök gelişiminde koyun gübresinin, sürgün gelişiminde ise sığır gübresinin daha etkili olduğu belirlenmiştir. Narince üzüm çeşidinde koyun gübresinin hem kök hem de sürgün gelişimi üzerinde sığır gübresine kıyasla daha olumlu sonuçlar verdiği ortaya koyulmuştur.
Anahtar Kelimeler: Asma çeliği, köklenme ve sürme, toprak fiziği, çiftlik gübresi

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1. Introduction

Sustainability in successful agriculture is inseparable with a fertile soil. Intensive agriculture and the use of various chemicals endanger the sustainability of agricultural activities. The decrease in the amount of organic matter due to increasing agricultural activities leads to the deterioration of the physico-mechanical structure of the soil after a while. Many studies have shown that organic fertilization is an effective method to increase soil organic matter content, soil fertility and organic carbon accumulation [1-9]. In agricultural production activities, the ability of the plant to develop well in the soil is related to the physical and chemical properties of the soil environment. The most used method to improve the physical properties of the soil and to ensure its sustainability is to add organic-based materials to the soil [10, 11].

Various materials such as farm manure, peat, compost are applied to keep the amount of organic matter in the soil at a certain level [12]. Soil organic matter plays a critical role in maintaining soil fertility and productivity [13, 14]. Studies in different parts of the world have shown that organic manures improve soil properties and increase the yield of crops [15]. In a 25-year study conducted by [16], farm manure was applied to the soil and it was reported that a significant increase in the amount of organic carbon and total nitrogen of the soil occurred due to this applications. [17], stated that if there is enough decomposed organic matter residues in the surface soil, it has a significant effect on the physical and chemical properties of the mineral soil. [18], reported that when a fertile soil is mentioned, it comes to mind that the soil has a high level of organic matter and biological activity, stable aggregates, an environment in which plant roots can easily move, and water can easily infiltrate from the surface. However, trying to keep organic matter in the soil at a high level is both impractical and very expensive. On the other hand, manure applications made by animal breeders on agricultural lands are an easy and low-cost way to provide organic fertilization. Farm animals provide the transport of plant nutrients from animal grazing areas to crop production areas as manure [19]. This situation increases the nutrient cycle and reduces the costs of industrial manures.

[20], stated that different types of manures of animal origin (goat, sheep, cow, poultry manure, etc.) have significant differences in macro and micronutrient content and therefore significantly affect the nutrition of the grown plant. [21] in a study investigating the effectiveness of livestock manure, found that goat manure has higher N, P and K concentrations (2.77% N, 1.78% P_2O_5 and 2.88% K_2O) compared to other animal manures. He also stated that sheep manure is a good source of K (1% K_2O). On the other hand, he stated that cow manure contains only 0.55% N, 0.10% P_2O_5 and 0.50% K_2O, while the Fe concentrations in different types of manures vary between 40 and 460 mg kg^{-1}, while the Mn and Zn contents vary between 5 and 90 mg kg^{-1}.

In the coming years, the use of organic manures to meet nutrient needs will become more common to develop sustainable agriculture. This is related to the improvement of organic manures in various yield parameters of the soil. Organic fertilization increases plant productivity by maintaining the quality of the produced crop [22] and positively affecting soil microbial biomass and activity [23]. Nutrient deficiency is one of the most important factors affecting yield and quality in agricultural production. Animal fertilization is effective in increasing the nutrient content of the soil over the years, depending on this, in the generative and vegetative development of the plant [24]. Animal manures such as cattle, sheep and horses are used as a food source for annual and perennial crops in horticulture. The effect of animal fertilization on fruit quality and nutritional value depends on several factors, including the properties of organic matter, pedoclimatic conditions, application time and plant species. [24]. As with other plant species, organic manures are of great importance on the nutrition of the vine. [25], stated that there is a significant relationship between soil quality indices and vegetative growth of grapevines. It has been stated in many studies that soils have both direct and indirect effects on root growth, photosynthesis and shoot growth of vines; various soil types were also found to have a measurable effect on vine vigor and fruit characteristics [26-28].

Ensuring of soil fertility is one of the most important goals for sustainable viticulture [29, 30]. [23], reported in a study that organic soil management is necessary for healthy plant growth and quality product in viticulture. Internal and external factors affect rooting in cuttings. Internal factors; Genetic structure, storage materials and hormones in the plant are shown as examples, while external factors; such as irrigation, pruning, fertilization, cutting time, rooting environment, temperature and humidity can be given as examples [31,32].

Vine nutrition is also important in rooting cuttings. Related to this, there are opinions that inorganic carbon compounds can stimulate adventitious root formation in grapevine cuttings. Macro and micro nutrients are also important in adventitious root formation. Especially nitrogen, magnesium, zinc and boron affect the adventitious root formation significantly [33].

In this study, the effect of cattle and sheep manures applied to the soils in different doses, on the aggregate stability, water permeability, bulk density and total porosity values of the soils, and in parallel with this, the bud burst rate and the rooting and shooting performances of 1 year old cuttings of Karaerik and Narince grape varieties were evaluated.

2. Material and Methods

The study was carried out in Atatürk University Faculty of Agriculture application greenhouse (humidity rate: 80-85%, temperature: 27-30 ^{o}C) in 2022. Since it is known that the rooting abilities of cuttings vary greatly between species and varieties [34, 35], two different grape varieties with different rooting abilities were preferred in this study.

In the research, one-year-old cuttings belonging to Karaerik and Narince cultivars were used as plant material. In this study, coarse textured soil with high permeability was used. The study soil was sampled as degraded from a 20 cm topsoil depth of a field in the Karaçam village of Çaykara district, Trabzon province [36]. In the research, at least 1 year old burnt cattle and sheep manure taken from Atatürk University Food and Livestock Application Center farm land was used.

Physical and chemical soil analyses

For fundamental analysis and trial studies, soil samples were air-dried in laboratory conditions and sieved through 4 and 2 mm mesh.

Soil texture was determined by Bouyoucos hydrometer method [37], soil reaction (pH) by glass electrode pH meter [38], lime content by Scheibler calcimeter (Nelson, 1982), organic matter content by Smith Weldon method [39], electrical conductivity (EC) value with electrical conductivity instrument [40], aggregate stability (AS) using Yoder type wet sieving device [41], particle density by pycnometer method [42], field capacity and permanent wilting point were determined by the pressure extractor method [43]. On the other hand, Soil bulk density was determined by the cylinder method [42], and total porosity was calculated from bulk weight and particle density.

Plant phenological observations and fertilization application

In this research, one-year-old cuttings belonging to Narince and Karaerik varieties, which are important table grape varieties, were taken from 6-year-old vines grown on their own roots in the unheated greenhouses of Atatürk University Plant Production Research Directorate. Samples were taken on April 1 in the form of 10-node rods, 10-12 cm long and 1-node cuttings were prepared.

Manures were mixed into potting soils at rates of 10% - 20% and 30% on a weight basis. On the 40th day of the experiment, the shooting performances (bud brust) were recorded, and at the end of the 60th day, the study was terminated and the root lengths, root numbers, shoot lengths and the number of leaves in the shoot were determined [44].

In the study, two different manures (cattle and sheep) were applied in 4 different doses (D0: 0%, D1: 10%, D2: 20%, D3: 30%). The research carried out on two different cultivars was planned with 3 replications and a total of 48 pots (2x2x4x3) were used. Statistical analysis was performed by ANOVA, and differences between means were tested using Duncan’s multiple range test [45, 46].

3. Results and Discussion

In this study, the texture class of the soils was determined as coarse textured in the sandy clay loam texture class (58% sand, 20% silt, 22% clay). Soil organic matter content (3.77%) is in the well class, pH level; It was found to be 7.5 level and neutral, the EC level of the working soils is 0.14 dS/m without salt, the $CaCO_3$ level was determined as 5.1% in the medium calcareous [47], class. According to the available phosphorus contents, the class of the soils was determined as medium (P_2O_5: 8 kg/da) [47], Ca++, Mg++, Na+, K+ contents were determined as 11.2, 5.04, 0.36, 2.17 me/100gr, respectively. Particle density were determined as 2.68 (g/cm^3). Field capacity and permanent wilting point moisture content of the working soil were determined to be 25% and 13%, respectively (Table 1).

Table 1. Basic physical and chemical analysis results of the researched soils

Soil properties	
Sand (%)	58
Silt (%)	20
Clay (%)	22
Texture class	Sandy clay loam
Particle density (g/cm^3)	2.68
Organic matter (%)	3.77
pH	7.5
EC (dS/m)	0.14
$CaCO_3$ (%)	5.1
Ca, Mg, Na, K (me/100gr)	11.2; 5.04; 0.36; 2.17
Field capacity (%)	25
Wilting point (%)	13

Soil physical properties

At the end of the 60-day plant development period of the soils applied with different doses of cattle and sheep manures; Aggregate stability, water permeability, bulk density and porosity values are given in Table 2.

Table 2. Effects of applications on the physical properties of soils

Applications	**AS (%)**	**WP (cm/h)**	**BD (gr/cm^3)**	**Porosity (%)**
D0 (Control)	$46.21^{d} \pm 3.35^{*}$	$4.6^{d} \pm 0.87$	$1.24^{a} \pm 0.02$	$53.4^{c} \pm 0.75$
M1-D1	$56.48^{bc} \pm 2.41$	$7.73^{c} \pm 0.58$	$1.16^{b} \pm 0.02$	$56.1^{b} \pm 0.61$
M1-D2	$57.43^{b} \pm 1.66$	$14.63^{b} \pm 3.97$	$0.98^{c} \pm 0.01$	$63.1^{a} \pm 0.35$
M1-D3	$69.54^{a} \pm 1.74$	$14.43^{b} \pm 0.72$	$0.97^{c} \pm 0.01$	$63.3^{a} \pm 0.17$
M2-D1	$52.63^{c} \pm 2.85$	$5.33^{cd} \pm 0.15$	$0.99^{c} \pm 0.01$	$62.5^{a} \pm 0.23$
M2-D2	$59.18^{b} \pm 2.84$	$5.43^{cd} \pm 0.68$	$0.98^{c} \pm 0.02$	$62.9^{a} \pm 0.55$
M2-D3	$60.38^{b} \pm 0.85$	$19.13^{a} \pm 0.66$	$0.97^{c} \pm 0.01$	$63.4^{a} \pm 0.17$

*: Standart deviation, AS: Aggregate stability, WP: Water permeability, BD: Bulk density; M1: cattle manure; M2: sheep manure; D0: 0% Control, D1: 10% dose, D2: 20% dose, D3: 30% dose

Aggregate stability, water permeability, bulk density and porosity values of the soils used in the research are given in Table 2. According to the results, it was found that different doses of cattle (M1) and sheep (M2) manure applications caused a statistical difference in all physical soil parameters examined ($p<0.05$).

When the effects of cattle and sheep manure applications on the aggregate stability values of the soil were examined, it was determined that all doses of both manures caused a statistical difference ($p<0.05$) in AS values compared to the control group (Table2). While the lowest value was determined to be 46.2% in the control group, it was revealed that the aggregate stability value increased linearly depending on the applications and the highest value was 69.5% in the D3 cattle manure application. When Table 2 was examined, it was determined that the different doses of sheep manure also increased the AS value, but cattle manure was more effective. When the effect of manure applications on the water permeability values of the soils was examined, it was determined that there was a statistical difference in the water permeability value compared to the control group ($p<0.05$). Considering all manure applications together, the highest water permeability value was 19.1 cm/h in the third dose application of sheep manure (M2-D3), and this value was followed by the 2nd (M1-D2) and 3rd (M1-D3) doses of cattle manure. It was determined that these applications increased the WP value by 315%, 218% and 213%, respectively (Table 2). When the bulk density values of the soils were examined, it was determined that manure applications showed a statistically significant difference ($p<0.05$) on the BD value compared to the control group. When Table 2 was examined, it was determined that the BD value decreased due to the increase in the application dose of cattle and sheep fertlizers, and the lowest values caused a decrease of 22% in the D3 application of both manures compared to the control group. The total porosity of the applied soils was statistically different compared to the control group ($p<0.05$). The lowest porosity value was determined to be 53.4% in the control group, while the highest value was 63.4% in the third dose application of sheep manure (M2-D3). This value was found to be 63.3% in the third dose application of cattle manure (M1-D3) and 62.9% in the second dose application of sheep manure (M2-D2) (Table 2).

The effects of the applications on the rooting and shooting performance of the cuttings

It was observed that there were differences between the bud burst rate of the cuttings of Karaerik and Narince grape varieties depending on the manure applications (Tablo 3). Root lengths, root numbers, shoot lengths and leaf numbers in the shoot of the cuttings used in the research are given in Tables 4 and 5. Rooting and shooting performances of Karaerik and Narince grape varieties of different manure applications are given in Figures 1 and 3. The relationship graphs between rooting and shooting performances and soil physical properties, depending on manure applications, are presented in Figures 2 and 4. According to the results, it was found that different doses of Cattle (M1) and Sheep (M2) manure applications caused a statistical difference on all rooting and shooting performances examined ($p<0.05$). On the 40th day of the experiment, the bud burst rates of the cuttings were examined. It was determined that 100% (all cuttings on three replication) burst was achieved in the 2nd and 3rd dose applications of cattle manure in Karaerik grape cultivar and in the 1st and 3rd dose applications in Narince grape cultivar. While there was no 100% bud burst (first shooting) at the end of the 40th day in sheep manure applied in Karaerik grape cultivar, 100% burst was observed in the second dose application of Narince grape cultivar in sheep manure (Table 3).

Table 3. Bud burst rates of grapevine cuttings at the end of the 40th day

Cultivars	**M1-D0 (%)**	**M1-D1 (%)**	**M1-D2 (%)**	**M1-D3 (%)**	**M2-D0 (%)**	**M2-D1 (%)**	**M2-D2 (%)**	**M2-D3 (%)**
Karaerik	66	66	100	100	66	66	33	33
Narince	33	100	66	100	33	66	100	66

M1: cattle manure; M2: sheep manure; D0: 0% Control, D1: 10% dose, D2: 20% dose, D3: 30% dose

When the effects of manure applications at different doses on root lengths of Karaerik and Narince grape varieties were evaluated, it was revealed that all doses of cattle and sheep manures were statistically different ($p<0.05$) compared to the control group (Table 4, 5). The most effective results on the root length of cuttings in Karaerik grape cultivar were determined in the 1st (M2-D1) and 2nd dose (M2-D2) applications of sheep manure and the 3rd dose (M1-D3) applications of cattle manure, respectively (Table 4). In Narince grape cultivar, the most effective results on the root length of cuttings were determined in the second dose of sheep manure (M2-D2) and 3 doses (M2-D3), respectively, and in the second dose of cattle manure (M1-D2) (Table 5). A statistical difference was found between the applications in terms of root numbers depending on the different doses of manure applications of Karaerik and Narince grape varieties ($p<0.05$). It was revealed that sheep manure was more effective than cattle manure on the root number of cuttings in Karaerik grape cultivar. The most effective results in terms of root numbers were determined in the first dose (M2-D1), second dose (M2-D2) and third dose (M2-D3) sheep manure applications, respectively (Table 4). It was determined that the most effective results in terms of root number of cuttings in Narince grape cultivar were in the second dose of sheep manure (M2-D2), the second dose of cattle manure (M1-D2) and the third dose of sheep manure (M2-D3) (Table 5). It was determined that manure applications at different doses caused a statistical difference ($p<0.05$) on shoot lengths of Karaerik and Narince grape varieties (Table 4, 5). It was determined that the highest value of shoot length in Karaerik grape cultivar was in the 3rd dose (M1-D3), 2nd dose (M1-D2) and 1st dose (M1-D1) applications of cattle manure, respectively (Table 4). When the shoot length of the cuttings of Narince grape cultivar was examined, it was determined that the highest values were observed in the 2nd dose (M2-D2), 3rd dose (M2-D3) and 1st dose (M2-D1) applications of sheep manure, respectively (Table 5). It was determined that all doses of applied cattle and sheep manures caused a statistically significant difference ($p<0.05$) on the number of leaves in the shoot. The highest number of leaves in Karaerik grape cultivar was determined in the 3rd dose application of cattle manure (M1-D3). This was followed by 2 doses (M1-D2) and 1st dose (M1-D1) applications of cattle manure, respectively (Table 4). In Narince grape cultivar, it was determined that the 2nd dose of sheep manure (M2-D2) had the highest effect, followed by the 1st (M2-D1) and 3rd (M2-D3) doses of sheep manure (Table 5).

Table 4. Rooting and shooting performances of Karaerik grape cultivar

Karaerik cultivar	Root Length (cm)	Root Numbers (item)	Shoot Length (cm)	Leaf Numbers (item)
M1-D0	$1.16^{d} \pm 0.28^{*}$	$1.33^{e} \pm 0{,}57$	$6^{cd} \pm 1$	$2.33^{d} \pm 0.57$
M1-D1	$2.33^{c} \pm 0.28$	$7.33^{d} \pm 1{,}52$	$12^{abc} \pm 2.64$	$7^{ab} \pm 1$
M1-D2	$5.76^{b} \pm 0.68$	$12.33^{c} \pm 1{,}52$	$13.66^{ab} \pm 4.5$	$7.66^{ab} \pm 1.52$
M1-D3	$6.66^{a} \pm 0.87$	$11.33^{c} \pm 0{,}57$	$15.66^{a} \pm 3.51$	$8.33^{a} \pm 1.52$
M1-Mean	**4.91**	**10.3**	**13.8**	**7.66**
M2-D0	$1.3^{d} \pm 0.36$	$1.66^{e} \pm 0{,}57$	$4.66^{d} \pm 2.08$	$2^{d} \pm 1$
M2-D1	$7.1^{a} \pm 0.1$	$34^{a} \pm 2{,}64$	$11.33^{abc} \pm 5.03$	$5.66^{abc} \pm 3.21$
M2-D2	$7.2^{a} \pm 0.2$	$18^{b} \pm 1$	$8.33^{bcd} \pm 2.51$	$3.33^{cd} \pm 1.52$
M2-D3	$5.26^{b} \pm 0.64$	$14^{c} \pm 2{,}64$	$9.33^{bcd} \pm 3.05$	$5^{bcd} \pm 2$
M2-Mean	**6.52**	**22**	**9.66**	**4.66**

M1: cattle manure; M2: sheep manure; D0: 0% Control, D1: 10% dose, D2: 20% dose, D3: 30% dose

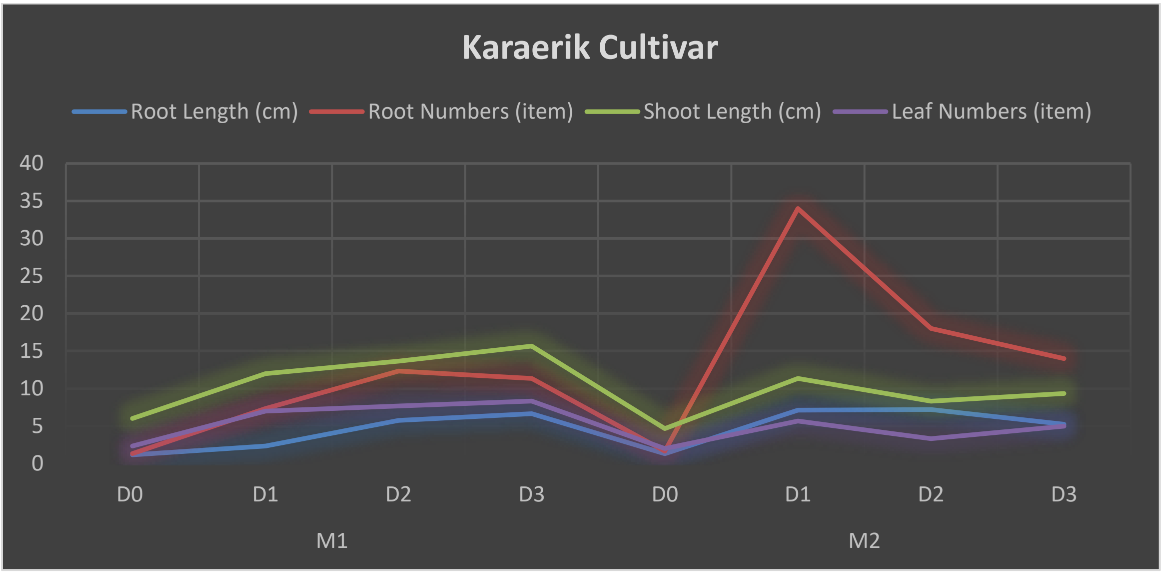

Figure 1. Rooting and shooting performance graph of cuttings of Karaerik grape cultivar

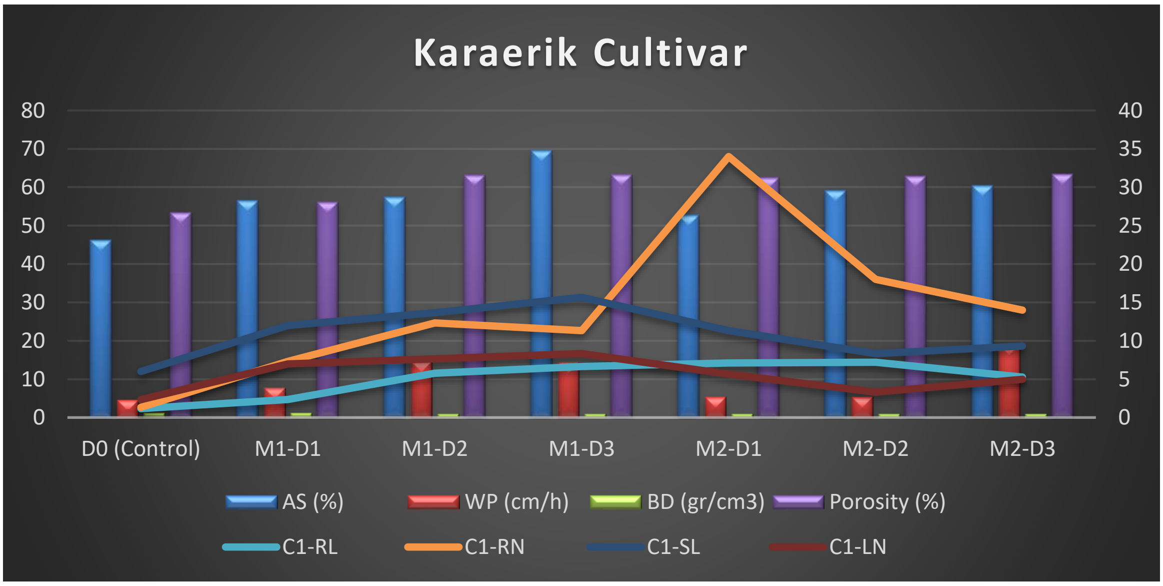

Figure 2. The relationship between rooting and shooting performances of Karaerik grape cultivar and soil physical properties.

AS: Aggregate stability, WP: Water permeability, BD: Bulk density; M1: cattle manure; M2: sheep manure; V1:Karaerik cultivar, RL:Root length, RN: Root numbers, SL: Shoot length, LN: Leaf numbers, D0: 0% Control, D1: 10% dose, D2: 20% dose, D3: 30% dose

Table 5. Rooting and shooting performances of Narince grape cultivar

Narince cultivar	Root Length (cm)	Root Numbers (item)	Shoot Length (cm)	Leaf Numbers (item)
M1-D0	$0.76^{e} \pm 0.25$	$2^{c} \pm 1$	$1.66^{d} \pm 0.57$	$1.33^{d} \pm 0.57$
M1-D1	$1.23^{e} \pm 0.25$	$3^{c} \pm 1$	$6.66^{c} \pm 1.52$	$3^{cd} \pm 1$
M1-D2	$5.96^{c} \pm 0.15$	$13.33^{b} \pm 0.57$	$8^{c} \pm 3.6$	$3.66^{c} \pm 2.08$
M1-D3	$3.86^{d} \pm 0.30$	$10^{b} \pm 1$	$7.66^{c} \pm 1.52$	$3^{cd} \pm 1$
M1-Mean	**3.68**	**8.76**	**7.44**	**3.22**
M2-D0	$1.23^{e} \pm 0.15$	$3^{c} \pm 1$	$8.66^{c} \pm 1.15$	$8.33^{b} \pm 1.52$
M2-D1	$3.56^{d} \pm 0.20$	$10.66^{b} \pm 0.57$	$9.66^{c} \pm 1.15$	$8.66^{b} \pm 1.15$
M2-D2	$7.43^{a} \pm 0.51$	$30.66^{a} \pm 6.11$	$25.66^{a} \pm 1.52$	$16.33^{a} \pm 0.57$
M2-D3	$6.56^{b} \pm 0.51$	$12.66^{b} \pm 0.57$	$15.33^{b} \pm 1.15$	$8.66^{b} \pm 0.57$
M2-Mean	**5.85**	**18**	**16.9**	**11.2**

M1: cattle manure; M2: sheep manure; D0: 0% Control, D1: 10% dose, D2: 20% dose, D3: 30%

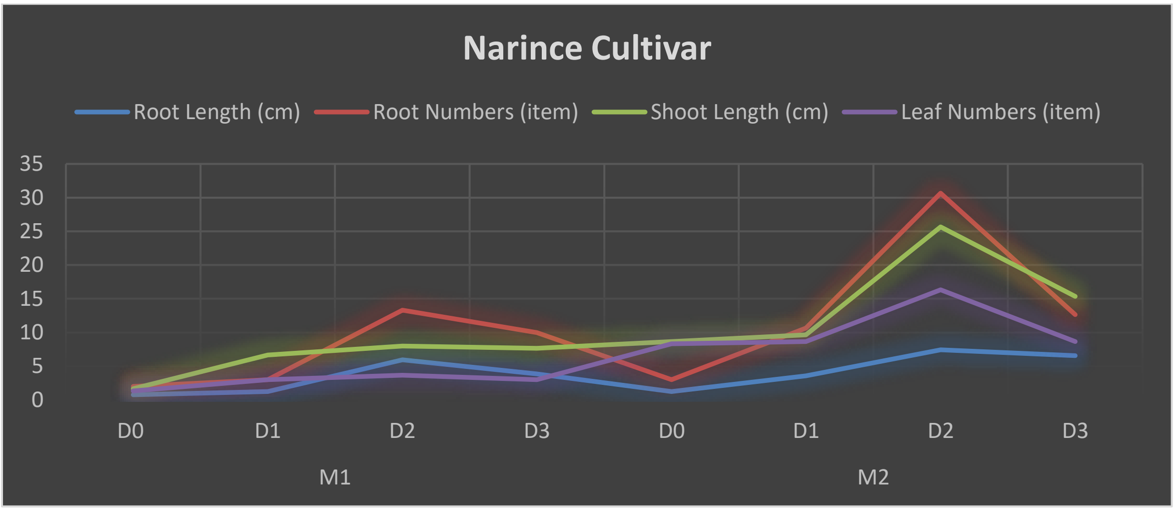

Figure 3. Rooting and shooting performance graph of cuttings of Narince grape cultivar

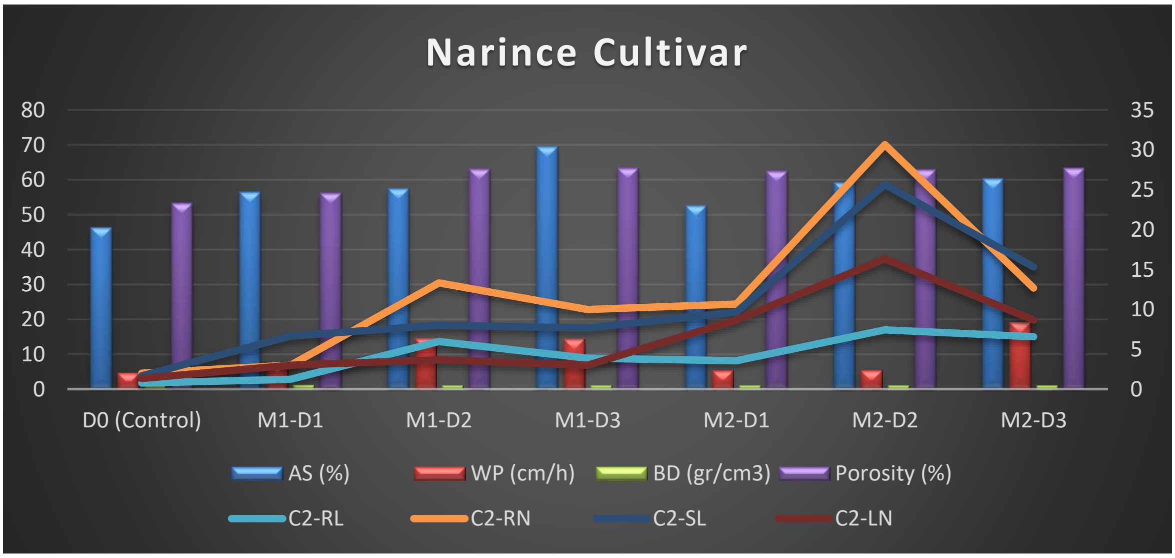

Figure 4. The relationship between rooting and shooting performances of Narince grape cultivar and soil physical properties.

AS: Aggregate stability, WP: Water permeability, BD: Bulk density; M1: cattle manure; M2: sheep manure; V2: Narince cultivar, RL: Root length, RN: Root numbers, SL: Shoot length, LN: Leaf numbers, D0: 0% Control, D1: 10% dose, D2: 20% dose, D3: 30% dose

When Figure 2 and Figure 4 are examined, it is understood that there is a relationship between the physical properties of soils and the vegetative development of plants. While manure applications improve the physical properties of the soil, they also affect the rooting and shoot performance of the plants. It was determined that there was a linear increase in AS, WP and porosity values depending on the increase in the application doses of both manures added to the soil. In parallel with the improvement in the physical properties of the soils, it was observed that the rooting and shooting performances of the cuttings also changed. While this development in soils was in direct parallel with the development of cuttings in cattle manure applied soils, it showed a partial parallelism in cuttings in sheep manure applied soils.

Fine textured heavy and impermeable soils limit root formation in plants and can cause root rot by holding excessive water. There is a significant relationship between root and shoot development in vines and soil fertility and water holding capacity [25]. The application of sheep and cattle manure to the soil increases the amount of organic matter in the soil, and accordingly, it provides a more suitable environment for plant growth by providing a positive effect on the soil's aggregate stability, water permeability, air-water balance, and uptake of plant nutrients in the soil.

For a good root formation, suitable soil air, soil water and enough oxygen must be present. It is known that organic matter affects plant vegetative and generative development positively by increasing aggregate stability, and reducing bulk density [48], It has been revealed in many studies that there is a direct relationship between soil carbon (C) content and soil aggregation, and that organic manures added to soil improve the structural properties by increasing the aggregate stability of the soil [6, 49-55]. Parallel to the improvement in soil physical properties, the increase in the water and nutrient holding capacity of the soil has come to the fore as important factors that can affect the yield of vines [27, 56, 57]. As a matter of fact, in this study, similar to other studies, it was determined that cattle and sheep manure applications improved the physical properties of the soils, increased the water permeability and aggregate stability values, decreased the bulk density values, and in parallel increased the rooting and shooting performance of the cuttings.

[58], stated that organic materials create a more suitable environment for plants and microorganisms by increasing the aeration capacity of soils, and this situation positively affects water and nutrient availability. It is known that root and shoot development in vines is strongly affected by soil conditions, shoot development is more in places where the soil is more fertile and can hold more water [27, 56]. It is known that the level of organic matter in the soil has a significant effect on the rooting performance of grapevine cuttings [59]. In this study, it was determined that fertilizations had a positive effect on average root length and root number depending on the manure in both Karaerik and Narince grape varieties, but sheep manure was more effective than cattle manure. In addition, it was determined that different doses of cattle and sheep manure increased shoot growth in grapevine cuttings. In the study, it was found that cattle manure in Karaerik grape cultivar and sheep manure in Narince grape cultivar were more effective on average shoot growth and average leaf number. Similar to the data we obtained in this study, [60], determined that the addition of organic manures at different doses to fig

seedlings had a significant effect on the shoot length of the plants. In addition, [61], in a study investigating the effects of farm manure on the soil, emphasized that the applications provided significant increases in crop yield by promoting vegetative growth of plants. Parallel to previous similar studies, the findings obtained in this study revealed that organic farm manures have significant effects on soil and plant growth.

4. Conclusion

Since organic manures generally improve the physical, chemical and biological properties of the soil, their use in sustainable agriculture is becoming more common every day to meet the nutritional needs. For this purpose, the effects on the rooting and shooting performances of Karaerik and Narince grape varieties were evaluated by applying different doses of organic farm manures from different origins to the soil. In the study, it was revealed that there was a linear development in the root length, root number, shoot length and number of leaves on shoot of both Karaerik and Narince grape varieties, depending on the improvements in the physical properties of the soils due to different manure applications. It was determined that sheep manure was more effective than cattle manure on root length and root number in Karaerik grape cultivar, while cattle manure gave more positive results on shoot length and number of leaves in shoot. Although all doses of cattle manure applied on Narince grape cultivar had positive effects on root length, root number, shoot length and number of leaves shoot, it was determined that sheep manure was more effective than cattle manure in all parameters. As a result, it has been determined that organic farm manures have been very successful in rootting and shoot development of vine cuttings, and it has been found to cause different results in species and varieties according to the origin of the manure.

According to the findings obtained in this study, it is thought that organic farm manures can come to the fore as a successful alternative for rooting vine cuttings in terms of soil health and sustainable agriculture.

Ethics in Publishing

There are no ethical issues regarding the publication of this study.

Author Contributions

Author[1]: Conceptualization, data curation, formal analysis, methodology, visualization, writing-original draft, writing-review and editing,
Author[2*]: Conceptualization, data curation, visualization, writing-original draft, writing-review and editing
All authors have read and agreed to the published version of the manuscript.

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