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Original scientific paper

DETERMINATION OF SOME QUALITY PARAMETERS OF TOMATO SEEDLINGS GROWN IN DIFFERENT SUBSTRATES

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ABSTRACT

This study was carried out to determinate the some quality of tomato (Falcon standart variety and Lice genotype) seedlings grown in different substrates during spring season of 2021 year. In the study, the seeds of tomato were sown in 350 cc capacity drained pet glasses filled with different mortar substrates in greenhouse of the Horticulture Department of the Faculty of Agriculture of Dicle University. As growing substrates of mortar used in the study; Soil (Control), Soil + Perlite (3/1 ratio), Soil + Water Retaining Polymer (3/1 ratio), Soil + Perlite (3/1 ratio), Soil + Vermiculite (3/1 ratio) and Peat + Perlite (3/1 ratio) were prepared as mortar materials. The parameters taken in all seedlings that have reached the thickness of a pencil and have removed their third-fourth true leaves were as follows; root length and diameter, plant height, stem weight, root weight, leaf weight, stem weight only, leaf area index, l*, a* and b* values, dry root, leaf and branch weights were measured. In the study, it was found that different mortar materials were effective on the parameters taken in tomato seedlings ($p < 0.01$). As a result of the measurements and observations, the best results were taken in Lice genotype respectively; peat + perlite > soil + polymer > soil + vermiculite > soil + perlite > soil. Seedlings of Falcon variety were obtained in the order of peat + perlite > soil + perlite; similar results were obtained in other mortar. The results obtained at the end of the study, it was determined that the use of peat perlite mixture mortar material or soil and water-holding polymers instead of only soil contributed to the development of seedlings.

Key words: Growing, Mortar, Quality, Seedling, Tomato.

INTRODUCTİON

In vegetable cultivation, starting production with healthy seedlings is the main condition for a successful production. A seedling is a young plant that is formed after the seed germination and has a few true leaves. Usega of high quality seedlings in vegetable growing has many advantages such as early crop production, saving seeds and energy, obtaining disease-free and undersized plants, and harvesting the plants in the same period can be provided (Demir, 2007).

After the 1900s, the ready-made seedling sector has been developing in the world (Pascual et al., 2018). Ready seedling production in our country is increasing day by day; many domestic and foreign companies produce seedlings both for the country and abroad. It was stated that there were 212 companies officially registered members of the Seedling Union in July 2022 in Turkey. It is stated that 212 members produce 182 vegetables, 27 strawberry, 2 tissue culture and 1 medicinal aromatic plant seedlings (Anonymous 1). Among these companies, 83 of them are located in Antalya, where agriculture is intensely. With the increase of these companies producing ready seedlings, seedling has became an important sector that also increases employment in our country (Balkaya et al., 2015). Seedlings belonging to tomato, pepper, cucumber, eggplant, melon, watermelon, lettuce, zucchini, cauliflower, cabbage, broccoli, celery and a few other vegetable groups are produced in the companies producing vegetable seedlings in our country (TAGEM, 2018). As a result of this, it is stated that the rate of usege of ready-made seedlings in greenhouse vegetable cultivation reaches 100%, and this rate reaches approximately 70% in open vegetable cultivation (Yelboğa, 2014). Judging by the mortar materials used in the production of ready seedlings, most of these materials are; inorganic (perlite, vermiculite, sand, etc.) materials and organic wastes (peat, grain, wood chips, vermicompost, etc.) (Polat et al, 2017; Donnan, 1998; Seymour, 1993). In the academic studies and business survey impressions, it is stated that the seedlings are grown only in peat medium generally have superior characteristics (Çelebi, 2019). Production costs have increased due to the decrease in peat beds, which have been widely used in seedling cultivation in the world and in our country until recently; alternatively, manufacturers seem to have started to use cockpits instead. In addition to these materials, materials such as locally sourced sawdust, hazelnut or paddy slag, various plant material residues are also used in seedling cultivation (Gül, 1991; Sevgican, 2003).

Since there is no clear information on the use of a mortar in accordance with the standards in our country for the mortar materials used during the seedling production; ın other words, since companies use different mortar materials in line with their own knowledge, it cannot be said that the following material can be used for seedling production. In order to find a solution to this problem, researchers tried many mortar materials in different vegetable seedling cultivation in their studies, and as a result of the reports presented, recommendations were given for different mortar materials in order to obtain quality products (Uzun et al. 2000).

While the mortar materials recommended in seedling cultivation are expected to provide nutrients to the plant (peat) and it is desired to keep the soil moist (perlite, vermiculite). For this purpose, researches are carried out by mixing different inorganic materials into these mortar materials at different doses. Another application that increases the humidity in the soil is provided by mixing the water-retaining polymers, which are called "water-keep" in the market, into the soil at certain doses. There are studies on the use of these polymers to increase the water keeping capacity of the soil in arid and semi-arid regions where rainfall and irrigation opportunities are limited (Johnson and Piper, 1997; Lobo et al., 2006). These superabsorbent polymers consist of a cross-linked polymer chain and can retain much more water than conventional soil-keeping materials (Esposito et al., 1996; Raju et al., 2003). It is stated that their application to the soil can increase the water keeping capacity of soils up to two times (Bhardwaj et al., 2007; Karimi et al., 2009).

When the academic studies are examined, the following are stated on the advantages of water-keep polymers; ıt is stated that water stress of plants can decrease, the water keeping capacity of the soil increases, the time between successive irrigations can be extended, plant growth rate and performance and root weight increase (Pill and Jacono, 1984; Viero et al., 2002; Han et al., 2005; Yu et al., 2012). In a study with the use of water-keeper polemers, it was found that in soils where water-keeper polymers were not applied, plants showed signs of dehydration during the water stress period; on the other hand, it has been reported that plants grown in water-keeper soil are healthier (Nnadi and Brave 2011). In addition to these advantages of water-keeper polymers, there are also reports on disadvantages in some studies. In these studies, it is reported that some results have been obtained that polymers are not beneficial to the plant in providing water and even harm plant life and crops (Han et al., 2010; Yu et al., 2012).

There are many academic studies on the mortar materials to be used in seedling cultivation. Altun (2008) compared the growth and yield of the lettuce in a lettuce grown in grapes mixed with different inorganic and organic substances. As a seedling growing medium;

1. Cibre (It is the little watery, less sugary part that remains after the must is taken, especially from grapes) the waste of grapes after, 2.Perlite, 3. Peat, 4. Dross 5. 75% cibre + 25% Oak Ash, 6. 75% cibre + 25% Poplar Sawdust, 7. cibre+10 g/L Gypsum, 8. cibre+ 10 g/L Gypsum, 9. 75% cibre + 25% Charcoal, 10. 90% cibre + 10% Charcoal, 11.% 70% cibre + 20% Fine Perlite+10% Charcoal, 12. 70% cibre + 20% Super Coarse Perlite+ 10% Wood Charcoal, 13. 75% Grain + 25% Fine Perlite, 14. 75% Grain + 25% Super Coarse Perlite, 15. 75% Grain + 25% dross. He reported that the best seedling growing medium was perlite, peat, gravy and a mixture of raisin-gypsum (10 g/L). He stated that there was very little germination in 75%cibre + 25% oak ash medium and the seedlings did not develop. Butt (2001) stated that perlite and peat were superior to soil mortar in both lettuce and tomato experiments in his studies in terms of seedling development.

Markovic et al. (1995), in their study of tomato and pepper seedlings grown in 8 different growing media, stated that the best seedling development was achieved with the use of zeoplant mixed with peat at a ratio of 2:1. Oktay et al. (1995) stated that the most suitable environment for the production of bell pepper is provided by mixing the growing material with the soil.

Güler (2011) in his study, in which he compared the development and yield of rock wool, perlite, zeolite, grape juice, and curly head lettuce grown in soil, as root medium in the seedling experiment; he used 1. Perlite, 2. Peat, 3. dross, 4. Zeolite, 5. Cocopeat, 6. Rock wool. At the end of the study, he reported that although the best root media are zeolite and perlite, respectively, they can be used in other media. Ece and Raviv et al. (1998) stated that the mixture of peat and vermiculite in organic seedling cultivation increased the fresh and dry weight of the seedlings, and the mortality rate of the seedlings decreased after planting in the field. Roe et al. (1997) stated that the best shoot development and plant growth in vegetables were obtained from seedlings grown with peat. Yılmaz and Kınay (2016) studied on the effects of different environments in production of goji bean seedlings, such as peat (100%), soil (100%), perlite (100%), sand (100%), peat-soil (50%, 50%).), peat-perlite (50%, 50%), peat-sand (50%, 50%), peat-soil-sand-perlite (25%, 25%, 25%, 25%) used 8 different media. Researchers reported that the best quality values were obtained in 100% peat environment.

Namal (2019) in their study to determine some physicochemical properties of different media used in seedling cultivation and the changes in seedling quality parameters of tomato (*Solanum lycopersicon* cv.), as a growing medium; they used proportional mixtures of peat, diatomite, zeolite and vermicompost. At the end of the study, he stated that 70% Peat + 10% Zeolite + 10% Diatomite + 10% Vermicompost medium is more advantageous in terms of seedling growth, yield and quality and can be easily used in seedling cultivation in soilless culture.

Polat et al. (2017) on the seedling quality of the Crimson Sweet watermelon cultivar in the environments in which the turf, peat, perlite, peat: perlite (1:1) mixture and garden soil were used as control; the use of perlite and gravel alone is not promising; they reported that different mixtures of peat and peat: perlite (1:1) gave the best results.

Özkaynak and Samancı (2004), studied to determine the effects of different growing media (peat:perlite mixture, 1.5:1, 2:1 and 3:1) on mini tuber production, 2:1 and 3:1 peat as growing medium in mini tuber production. They stated that peat:perlite mixture can be used.

Demir et al. (1996), in their studies they used blocks obtained from different media in tomato seedling cultivation; they studied by mixing peat, classical mortar, mushroom compost, tuff and different combinations of these media. As a result of the experiment, it was stated that the best seedling growth was in the peat + mushroom compost media, followed by the mushroom compost and peat + mushroom compost + classical mortar mixture, respectively, and these media could be easily used in seedling cultivation.

With this study, the expewriment was established to determine the best media contain different mortar materials that show better growth of local Lice tomato and Falcon variety tomato seeds until planting period after germination in vegetable seedling cultivation.

MATERIAL AND METHOD

Drained pet glasses with a capacity of 350 cc were used as flower pots. Soil (Control), Soil + Perlite (3/1 ratio), Soil + Water Retaining Polymer (3/1 ratio), Soil + Perlite (3/1 ratio), Soil + Vermiculite (3/1 ratio) and after the mixture of Peat + Perlite (3/1 ratio) was made homogeneously, it was filled into glasses. Then, Falcon type standard tomato seed, which is a plant material, and Lice genotype tomato seeds, which were previously collected in our department and used in characterization studies, were planted in these glasses as two pieces/pot.

The study was carried out in the application and research greenhouse of the Department of Horticulture, Faculty of Agriculture, Dicle University in 2021 spring period. Drained pet glasses with a capacity of 350 cc were used as seedlings pots. Soil (Control), Soil + Perlite (3/1 ratio), Soil + Water keper Polymer (3/1 ratio), Soil + Perlite (3/1 ratio), Soil + Vermiculite (3/1 ratio) and after the mixture of Peat + Perlite (3/1 ratio) was mixed homogeneously, and filled into pots. Then, Falcon type standard tomato seed, which is a plant material, and Lice genotype tomato seeds, which were previously collected in our department and used in characterization studies, were sown in these pots as two seeds/pot. Along with the germination and emergence of the seeds, fungicide application on different days at 15-day intervals and 20-20-20 NPK fertilizer were given from the leaves and fertilization was applied for both protection and nutrition of the plants. For the trial termination period, it was terminated when all seedlings were seen, which had reached the thickness of a pencil with having third-fourth true leaf. The seedlings were washed under tap water so that there was no soil left in the roots, and measurements and observations were taken in pomology laboratory of the Department. The parameters; root length and diameter, plant height, stem weight, root weight, leaf weight, stem weight only, leaf area index, l*, a* and b* values, dry root, leaf and branch weights were taken.

Statistical Analysis

The data obtained from the study were made using the analysis of variance in the JMP statistical program. The mean differences between the groups were examined by LSD test.

RESULTS AND DISCUSSION

In this study, which was carried out in order to obtain better quality seedlings in which environments the plants reached the planting stage (3rd and 4th true leaves and have a pencil-thick stem) seedlings of different structures were obtained between applications.

When Table 1 was examined, it was determined that the SPAD readings of the Lice genotype had a significant effect on the seedlings grown in different growing media ($p<0.05$). Compared to the control group, the highest SPAD value was obtained from seedlings grown in peat + perlite medium with an increase of 22.59 %. Plants in the Soil+Vermiculite medium followed this increase in the second place with an increase of 12,48%. In general, SPAD readings in all media were found to be higher than the control group. When Table 1b is examined, the highest change in seedlings of Falcon variety was obtained from pots with Peat+Perlite mortar as in Lice seedlings (43,44). However, SPAD values of seedlings in all other media were found lower than the control group. The lowest value was obtained from seedlings with soil+perlite media with a decrease of 12.25% compared to the control group (36,26). In their studies, Namal (2019) found the highest amount of chlorophyll in 70% Peat + 15% Diatomite + 15% Vermicompost (45.27spad) medium with spad readings; stated that the lowest amount of chlorophyll obtained 100% Peat (31.47). Researchers have reported that the chlorophyll content in the leaf is important in dry matter production (Taiz and Zaiger 2008; Kırbay and Özer 2015).

In the statistical analysis for the root diameter of the plant, the difference between the applications was statistically significant (P<0.005). When root diameter values were examined, an increase of 29.38% was obtained in Lice genotype compared to the control group (5.46 mm). Seedlings in pots with peat + perlite in the second place followed with an increase of 16.11%. Seedlings in other media decreased compared to the control group. In the seedlings of Falcon variety, the best values were obtained in media with peat + perlite with an increase of 8.56% compared to the control group (5.20 mm). In the second place, it was obtained from seedlings belonging to the soil + perlite group with an increase of 6.47%. In terms of root diameter, the lowest root diameter was obtained as a result of polymer application (4.56 mm). Namal (2019) investigated the changes in some physicochemical properties and tomato seedling quality parameters of different media used in seedling cultivation. + 20% Vermicompost medium (3.54 mm). He reported that he obtained the lowest stem diameter (2.35 mm) from 70% Peat + 15% Zeolite + 15% Diatomite medium.

In the statistical analysis for plant height in the study, the difference between the applications was statistically significant (P<0.001). The best values in Lice genotype compared to the control group were obtained from seedlings in pots containing peat + perlite with an increase of 14.84% (25.38 cm). In the second place, it was obtained from seedlings in soil + vermiculite media with an increase of 7.24% (23.70 cm). The shortest plant height was measured (21.30 cm) in seedlings in pots containing soil + perlite. The tallest plant height in the seedlings of Falcon variety was obtained from the seedlings in peat + perlite containing media with an increase of 19,03% compared to the control group (26.90 cm). In the second place, it was obtained from seedlings in media containing soil + polymer with an increase of 6.81% (24.14 cm). As in the Lice seedlings, the plant height of the seedlings in the media with soil + perlite was determined as the shortest (19,28 cm) in the seedlings of Falcon variety. Maboko (2006) stated that the use of water retention in tomato (*Lycopersicon esculentum*) and *lettuce* (*Lactuca sativa*) species has a positive effect on plant growth, yield, flowering and quality. Shooshtarian et al. (2011) stated that the use of water-retaining polymers in seasonal plants, groundcovers, grasses, trees and some ornamental plants in the shrub group in arid and semi-arid regions positively affects plant growth. Roe et al. (1997) reported that plant growth and shoot development were positively affected in vegetables obtained from seedlings grown with peat. In the study of Namal (2019), the highest length in tomato seedlings was obtained from 80% Peat + 20% Vermicompost (22.21cm) and 70% Peat + 15% Zeolite + 15% Vermicompost (22.12 cm) media. He stated that the lowest value in 70% Peat + 15% Zeolite + 15% Diatomite (10.85 cm) medium.

In the statistical analysis for root length, the difference between the applications was statistically significant (P<0.001). Root length in lice genotype was found longer than the seedlings in the control group in all different media. The longest root length was measured from seedlings in soil + perlite medium with an increase of 87.59% (27.20 cm). In the second place, it was obtained from seedlings in soil + polymer medium with an increase of 51.72% (22 cm). In the seedlings of Falcon variety, the longest root length was obtained from plants in peat + perlite medium (24.20 cm). In general, it was determined that root lengths were shortened as a result of other applications. It was obtained from seedlings in soil polymer medium with the shortest root length of 19.05 cm.

In the statistical analysis for body weight in the study, the difference between the applications was statistically significant (P<0.005). In Lice genotype, the heaviest stem structure was obtained from the seedlings grown in peat + perlite medium with an increase of 30.24% compared to the control group (6.03 gr). The lightest stem weight was obtained from seedlings in soil+perlite medium (3.96 g). In the seedlings of the Falcon variety, the heaviest stem structure was found in the soil + perlite group (6.63 g), with an increase of 28.74%; In the second place, it was obtained with an increase of 25.63% in plants in the peat + perlite group (6.47 gr). In the seedlings in the media with soil + polymer and soil + vermiculite, a decrease in stem weight was obtained compared to the control group (4.75 g and 5.07 g). Akdağ (2007) compared the growth and yield of the lettuce seedlings grown in perlite, peat and gravel media after planting in the greenhouse soil. reported that it has. These results also confirm our findings. In the study of Namal (2019), the highest wet weight value was obtained from 70% Peat + 10% Zeolite + 10% Diatomite + 10% Vermicompost (144.44 g) medium; the lowest wet weight was obtained from 70% Peat + 15% Zeolite + 15% Diatomite (37.14 g) medium. Yilmaz et al. (2015), when evaluating the seedling fresh weights of tomato seedlings grown in different medias, stated that the highest value (110.73 g) was obtained from a mixture of 80% peat and 20% vermicompost of peat and vermicompost.

In the statistical analysis for root weight in the study, the difference between the applications was statistically significant ($P<0.001$). In the Lice genotype, the highest root weight was 36.43% compared to the control group, soil vermiculite; It was obtained from soil+perlite application with an increase of 30.24% and soil+polymer with an increase of 18.21%. In the peat+perlite application, it was determined that the seedlings had the lightest weight with a decrease of 5.15% compared to the control group (2.76 gr). In Falcon cultivar, the highest root weight was obtained from soil+perlite application with an increase of 59.32% compared to the control group and from soil+vermiculite application with an increase of 40.40%. As in Lice, the lightest root weight was obtained from seedlings in the family peat + perlite medium with a decrease of 25.14% compared to the control group. Raviv et al. (1998) stated that the mixture of vermiculite and peat in seedling cultivation increased dry and fresh weight of seedlings. Agaba et al. (2011) reported that the water-keeping polymers used in the grass species *Agrostis stolonifera* increased the root biomass of plants 4-fold and had positive effects on root weight. Güler (2011) in his study, in which he compared the development and yield of rock wool, perlite, zeolite, grape juice, and curly head lettuce grown in soil, as root medium in the seedling experiment; He used 1.Perlite, 2. Peat, 3. Grass, 4. Zeolite, 5. Cocopeat, 6. Rock wool. At the end of the study, he reported that although the best root media are zeolite and perlite, respectively, they can be used in other media. In the study of Namal (2019), the highest seedling root weights were obtained from 70% Peat + 10% Zeolite + 10% Diatomite + 10% Vermicompost (19.12 g); the lowest seedling root weight was obtained from 80% Peat + 20% Zeolite (3.31 g) medium. Yilmaz et al. (2015), the best results in seedling root weights were 80% zeolite + 20% Vermicompost (47.24 g), 40% peat + 40% zeolite + 20% vermicompost (40.64 g) and 40% peat + 40% zeolite + 20% vermicompost. (40.00 g) reported that they obtained in the medium.

In the statistical analysis for leaf weight in the study, the difference between the applications was statistically significant ($P<0.001$). In the Lice genotype, the highest increase in leaf weight compared to the control group was obtained from plants taken from peat + perlite media with an increase of 44.55% (3.05 g); Compared to the control group, the lowest weight was obtained from soil + perlite medium with a decrease of 18,48% (1.72 g). When the plants belonging to the Falcon variety were examined, the highest weight value was obtained from peat + perlite medium with an increase of 67.87% compared to the control group (3.71 gr); the lightest one was obtained from plants in soil + vermiculite medium, which did not change comparing with control group and had the same value (2.21 gr).

When the leaves and roots of the plant were removed and only the stem was weighed, the difference between the treatments was statistically significant ($P<0.001$; $P<0.005$) in the statistical analysis for the stem weight of the Lice genotype and Falcon cultivar. In the lice genotype, the heaviest stem structure was detected with an increase of 35.22% compared to the control group (3.34 g); the lightest stem weight was obtained from plants belonging to the control group (2.47 g). In Falcon cultivar, the heaviest stem weight was detected in the peat+perlite group with an increase of 19,03% compared to the control group (3.44 gr); the lightest stem weight was obtained from plants belonging to the soil+polymer group with a decrease of 9% compared to the control group (2.63 g).

Considering the weight of the dry roots of the seedlings, the difference between the applications was statistically significant (P<0.001; P<0.005) for Lice genotype and Falcon cultivar. In Lice genotype, the heaviest dry root structure was obtained from the plants belonging to the soil + polymer application with an increase of 60.71% compared to the control group (0.45 g); the lowest weight was obtained from plants belonging to the control group (0.28 g). In Falcon variety, the heaviest dry roots were obtained from the soil + perlite applied pots (0.49 gr) with an increase of 16.67% compared to the control group; the lowest weight was obtained from pots treated with peat + perlite (0.38 gr). Namal (2019), in his study, obtained the highest seedling root dry weight from 70% Peat + 10% Zeolite + 10% Diatomite + 10% Vermicompost (1.32 g), and 70% Peat + 15% Zeolite + 15% Vermicompost (1.13 g) has done.

The lowest value was determine considering the weight of the dry leaves of the plant, the difference between the applications was found to be statistically significant (P<0.001; P<0.005) in the statistical analysis for the dry root weight of the Lice genotype and Falcon cultivar. In the lice genotype, it was determined that the weight of dry leaves obtained from plants in all environments increased compared to the control group. The heaviest dry leaves were obtained from pots in peat + perlite medium with an increase of 73.33% compared to the control group (0.52 g). The lightest dry leaf weight was obtained from the plants in the control group (0.30 g). When dry leaf weights of Falcon cultivar were examined, it was determined that there was no decrease in dry leaf weights compared to the control group as a result of all applications. The highest weight was obtained from peat+perlite and soil+perlite applications with 43.59% increases compared to the control group (0.56 gr). The lowest weights were obtained from the control group and pots with soil+polymer application (0.39gr).d in 70% Peat + 15% Zeolite + 15% Diatomite (0.42 g) medium.

Considering the dry stem weights of the plant, the difference between the treatments was statistically significant (P<0.005; P<0.001) for Lice genotype and Falcon cultivar. It was determined that there was an increase in dry stem weight of the plants in all growing media in Lice genotype. The highest stem weight was obtained from plants in peat + perlite medium with an increase of 40.54% compared to the control group (0.52 g). The lowest weight was obtained from the plants in the control group (0.37 g). In Falcon cultivar, the highest dry body weights were obtained from plants in pots with peat+perlite applied (0.55 g); the lowest weight was obtained from soil + vermiculite application with a decrease of 9.52% compared to the control group (0.38 gr). In Namal (2019) studies, the highest seedling dry weight was obtained from 70% Peat + 10% Zeolite + 10% Diatomite + 10% Vermicompost (15.24 g); reported that the lowest seedling dry weight was obtained from 70% Peat + 15% Zeolite + 15% Diatomite medium. In general, high seedling dry weights indicate that the growth rate of plants is high (Uzun et al. 1998).

Table 1a. Parameters taken in Lice genotype

MEASUREMENTS	Soil (Control)	Peat+Perlite	% CHANGE	Soil+Perlite	% CHANGE	Soil+Polymer	% CHANGE	Soil+Vermiculite	% CHANGE	P Value	CV	LSD
SPAD	36.38±1.32 B	44.60±1.13 A	22.59	38.12±0.78 B	4.78	39.68±0.80 B	9.07	40.92±0.36 AB	12.48	0.0006	5.88	4.30
ROOT DIAMETER	4.22±0.16 BC	4.90±0.14 AB	16.11	4.19±0.16 BC	-0.71	5.46±0.27 A	29.38	3.98±0.12 C	-5.69	0.0004	9.81	0.87
PLANT LENGTH	22.10±0.17 B	25.38±0.66 A	14.84	21.30±0.51 B	-3.62	22.60±0.52 B	2.26	23.70±0.49 AB	7.24	0.001	5.43	2.56
ROOT LENGTH	14.50±0.27 C	17.70±1.20 C	22.07	27.20±0.51 A	87.59	22.00±0.85 B	51.72	16.50±0.48 C	13.79	<.0001	9.45	3.20
PLANT WEIGHT (LEAVES)	4.63±0.09 B	6.03±0.25 A	30.24	3.96±0.21 B	-14.47	4.71±0.15 B	1.73	4.63±0.33 B	0.00	0.0004	11.51	0.95
ROOT WEIGHT	2.91±0.08 C	2.76±0.05 C	-5.15	3.79±0.14 AB	30.24	3.44±0.07 B	18.21	3.97±0.02 A	36.43	<.0001	6.24	0.36
LEAF WEIGHT	2.11±0.07 C	3.05±0.06 A	44.55	1.72±0.04 D	-18.48	2.31±0.03 BC	9.48	2.52±0.07 B	19.43	<.0001	5.91	0.28
Plant WEIGHT	2.47±0.08 C	3.34±0.08 A	35.22	2.66±0.07 BC	7.69	3.00±0.10 AB	21.46	2.52±0.10 C	2.02	<.0001	7.82	0.50
LEAF AREA	84.15±2.84 B	114.30±0.92 A	35.83	60.69±0.65 C	-27.88	82.70±1.71 B	-1.72	81.15±0.68 B	-3.57	<.0001	4.71	7.73
l*	35.37±0.92 A	31.66±0.58 B	-10.49	30.39±0.19 B	-14.08	32.42±0.58 AB	-8.34	31.72±0.87 B	-10.32	0.0038	5.26	2.91
a*	-2.63±0.15 B	-2.40±0.16 B	-8.75	-1.88±0.08 AB	-28.52	-2.43±0.07 B	-7.60	-1.03±0.45 A	-60.84	0.003	-27.71	1.03
b*	8.85±0.04 A	6.58±0.06 CD	-25.65	6.15±0.07 D	-30.51	7.41±0.14 B	-16.27	6.90±0.23 BC	-22.03	<.0001	4.55	0.60
Dry root weight	0.28±0.01 C	0.41±0.01 AB	46.43	0.40±0.01 AB	42.86	0.45±0.02 A	60.71	0.35±0.02 B	25.00	<.0001	8.70	0.06
Dry leaf weight	0.30±0.01 C	0.52±0.01 A	73.33	0.50±0.01 A	66.67	0.38±0.00 B	26.67	0.41±0.01 B	36.67	<.0001	4.77	0.04
Dry plantweight	0.37±0.02 B	0.52±0.02 A	40.54	0.46±0.02 AB	24.32	0.40±0.01 B	8.11	0.44±0.03 AB	18.92	0.0014	10.95	0.08

Table 1b. Parameters taken in Falcon variety

MEASUREMENTS	Soil (Control)	Peat+Perlite	% CHANGE	Soil+Perlite	% CHANGE	Soil+Polymer	% CHANGE	Soil+Vermiculite	% CHANGE	P Value	CV	LSD
SPAD	41.32±1.06 A	43.34±0.37 A	4.89	36.26±0.64 B	-12.25	36.86±0.40 B	-10.79	41.08±0.27 A	-0.58	<.0001	3.86	2.73
ROOT DIAMETER	4.79±0.14 AB	5.20±0.15 A	8.56	5.10±0.07 AB	6.47	4.56±0.15 B	-4.80	4.90±0.08 AB	2.30	0.0325	6.18	0.64
PLANT LENGTH	22.60±0.54 B	26.90±0.63 A	19.03	19.28±0.27 C	-14.69	24.14±0.58 B	6.81	23.78±0.44 B	5.22	<.0001	5.48	2.44
ROOT LENGTH	23.30±0.54 AB	24.20±0.42 A	3.86	21.50±0.63 B	-7.73	19.05±0.27 C	-18.24	22.92±0.39 AB	-1.63	<.0001	5.27	2.26
BODY WEIGHT (LEAVES)	5.15±0.17 BC	6.47±0.51 AB	25.63	6.63±0.22 A	28.74	4.75±0.19 C	-7.77	5.07±0.24 BC	-1.55	0.0019	13.12	1.45
ROOT WEIGHT	3.54±0.15 C	2.65±0.11 D	-25.14	5.64±0.13 A	59.32	3.05±0.16 CD	-13.84	4.97±0.06 B	40.40	<.0001	7.95	0.61
LEAF WEIGHT	2.21±0.07 B	3.71±0.08 A	67.87	3.41±0.12 A	54.30	2.60±0.05 B	17.65	2.21±0.09 B	0.00	<.0001	7.49	0.43
BODY WEIGHT	2.89±0.06 ABC	3.44±0.08 A	19.03	3.21±0.13 AB	11.07	2.63±0.11 C	-9.00	2.71±0.18 BC	-6.23	0.0025	10.08	0.63
LEAF AREA	88.45±2.12 CD	134.03±2.84 A	51.53	111.03±1.76 B	25.53	91.70±1.12 C	3.67	78.96±1.82 D	-10.73	<.0001	4.98	8.99
l*	27.07±0.39 B	32.24±0.42 A	19.10	28.67±0.53 B	5.91	28.80±0.13 B	6.39	31.47±0.33 A	16.25	<.0001	3.24	2.51
a*	0.13±0.37 AB	0.81±0.13 A	523.08	-1.47±0.20 BC	-1230.77	-2.20±0.17 C	-1792.31	-0.24±0.62 AB	-284.62	0.0003	-146.88	1.57
b*	3.43±0.13 C	4.50±0.16 B	31.20	6.16±0.18 A	79.59	4.83±0.31 B	40.82	6.51±0.16 A	89.80	<.0001	9.73	0.89
Dry root weight	0.42±0.01 AB	0.38±0.01 B	-9.52	0.49±0.02 A	16.67	0.45±0.01 A	7.14	0.48±0.01 A	14.29	0.0005	7.50	0.06
Dry leaf weight	0.39±0.02 B	0.56±0.02 A	43.59	0.56±0.04 A	43.59	0.39±0.02 B	0.00	0.40±0.02 B	2.56	0.0003	13.85	0.12
Dry body weight	0.42±0.02 B	0.55±0.01 A	30.95	0.44±0.01 B	4.76	0.39±0.01 B	-7.14	0.38±0.02 B	-9.52	<.0001	8.90	0.07

CONCLUSION

The use of appropriate seedlings, which is one of the most important stages of quality vegetable cultivation, is a material that will directly affect the yield. It is inevitable that the seedlings will dry out as a result of planting the seedlings with weak and small stems or roots to be obtained. For this reason, the lighting of the seedlings areas, humidity and temperature in optimum conditions, as well as the mortar materials that can be supplied and used according to the vegetable species and varieties to be produced have great importance. When the evaluation is made according to the data obtained at the end of the study; the highest results in seedling fresh and dry weight values, root fresh and dry weight, which are among the parameters expected from a quality seedling, were generally obtained from peat + perlite medium; Good results were also obtained from other media such as soil+vermiculite, soil+perlite and soil+polymer media. In the study of Altun (2008), in the seedling period results; stated that the best medium according to stem length was peat, followed by perlite. He also stated that perlite and peat are the best environments according to rooted seedling weight, stem diameter and number of true leaves. The results of our study showed that the use of peat increased the seedling quality. The high yield obtained with the use of peat in many parameters is thought to be due to the positive benefit of the nutrients in the peat content to the plant. With this study, it is aimed that other inorganic materials mixed with the soil can contribute positively to the seedling quality parameters in cases where peat is not necessarily used. In addition, it has been demonstrated by this study that the use of water-keeping polymers, which have recently been sold in the market, can also benefit for plants. It can also recommended to try similar studies in different species, cultivars and growing periods for seedling production, which is the main subject in plant breeding.

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