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Research Article

Effects of planting dates on yield, plant nutrient content and quality of some melon (*Cucumis melo L.*) genotypes in Southeastern Anatolia of Turkey

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Öz

Bu çalışma, Şırnak- İdil iklim koşullarında değişik ekim zamanlarının, denemeye alınan kavun genotipleri verimve bitki/ meyve besin element üzerine etkilerini belirlemek amacıyla 2019 yılında yürütülmüştür. Denemeler tesadüf bloklarında bölünmüş parseller deneme desenine göre 3 tekerrürlü olarak düzenlenmiş, mayıs- Ağustos aylarında yürütülmüştür yürütülmüştür. Araştırmada, kavun bitki yeşil akamsında besin elementlerin (N,P, K, Ca, Mg, Fe, Cu, Mn, Zn), BRİX, Green effect on color density (SPAD) ve Toplam hasatini incelenmiştir. Elde edilen sonuçlara göre, Ekim zamanının verim üzerinde etkisi önemli görülmüşolup en yüksek toplam verimi Destari kavun genotipinde (3788 kg da^{-1}) 20 Mayıs ekim uygulamasından elde edilmiştir. potasyum, kalsiyum, Mikro element (Zn, Cu, Fe, Mn) ve BRİX bakımında ekim zamanları yönünden önemli farklılıklar görülmemiştir. Sonuç olarak 20 Mayıs ekimde tüm analizlerde kavun genotiplerinin ekilmesi durumunda olumlu sonuçlar elde edilebileceği kanaatine varılmıştır.

Anahtar kelimeler: Kavun, ekim zamanı, verim, Mikro ve Makro Element , SPAD

Güneydoğu Anadolu Bölgesi'ndeki bazı kavun (*Cucumis melo* L.) genotiplerinde ekim tarihlerinin verim, bitki besin maddesi içeriği ve kalitesi üzerine etkileri

Abstract

This study was conducted to determine the effects of different planting dateson yield and nutrient contentsof three melon genotypes under semi-aridclimate conditions in 2019. Layout of the experiment wasrandomized block with 3 replications. Nutrient contents(N, P, K, Ca, Mg, Fe, Cu, Mn andZn), brix value, chlorophyll (SPAD) content and total yieldofthree melon genotypes were determined. The results indicated that the effect of planting time on melon yield was significant.The highest total yield (3788 kg da^{-1}) was obtained in May 20 planting treatment with Destari melon genotype. Potassium, Ca, Zn, Cu, Fe, Mncontents and BRIX according to the planting times.The results revealedthat nutrient content and yield of melon genotypes planted on May 20 were better compared to the other planting dates investigated.

Keywords: Melon, planting time, yield, micro and macro nutrient, SPAD

Introduction

Melon (*Cucumis melo* L.)isan important horticultural crop andgrown in tropical, subtropical and temperate regions of the world. Iran isknown as one of the main origin of melon (Kerje and Grum, 2000), though half of the melon production (51%) in the world takes place in China, followed by Turkey and Iran with 5 and 6 percent of melon production (FAOSTAT, 2017).Extensive melon production in Turkey has been attributed to the presence of many cultures and wild varieties of melon in the Anatolia that is consideredas one of the homelands of melon. Melon is commonly cultivated in Aegean, Marmara, Mediterranean, and Central,Eastern and Southeastern Anatolia regions. The melon is mostly cultivated in open fields, where summer varieties are preferred. The most cultivated melon varieties, in Turkey are round Kırkağaç (60%), oval Kırkağaç (30-35%) and nest and Hasan bey (5-10%), respectively (Çoşkun, 2008). Melon production of Turkey in 2012 was 1688687 tons in 796417 da field. Çankırı province is one of the most melon producing cities of the country. In Çankırı, melon production was 56856 tons in 35431 da field, of which 22995 da (64.9%) was in Kızılırmak district with 41 391 tons (72.7%) of melon production.

Similar to the other vegetables and fruits, melon has severalbenefits for human health. The protein, carbohydrate, fat and energy values of 100 g edible melon portion are 0.7g, 7.5g, 0.2g and 30 calories, respectively. In addition,100 g edible portion of melon contains33 mg of vitamin C, 16 mg of potassium, 14 mg of calcium, and plenty of vitamin A and B (Vural et al., 2000).

Global circulation models developed to investigate the impacts of temperature increase indicated that adverse effects of global warming which occurred due to the anthropogenic increase of greenhouse gas concentrations in the atmosphere will primarily be experienced in high latitudes (Maxwell 1992, Houghton et al. 1996).

In general, planting time and field conditions affect plant growth and crop yield. Similarly, planting time of melon has a significant influenceon yield and quality (Saglam and Yazgan 1999; Khan et al., 2001; Refai et al.,2008; Dufault et al., 2006). Early sowing of melon varieties significantly affected the flowering and fruit setting due to the effect on the days of germination (Khan et al., 2001).In contrast to the effects of early sowing reported in previous studies, Dufault et al., (2006) indicated no advantage of early planting. Therefore, this study aimed to determine the effects of different planting times on yield, quality and nutrient contents different melon genotypes grown in Şırnak, Turkey ecological conditions.

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Materyal ve Metot

The experiment was conducted atthe research fields of Agricultural Faculty in Sirnak University between May and August,2019. Local melon varieties (Sagsana, Ceriki and Destarki) were used as the plant materials of the experiment (Figure 1). Four different planting dates (May5, 20 and 31 and June 15) were tested in the study. The experiment was carried out under rainfed conditions. also, the climate characteristics are given in figure 2.

Figure 1. Melon genotypes used in the experiment.

Total yield, fruit size, fruit diameter, number of fruits per plant, Brixvalue and chlorophyll (SPAD) contentofmelon fruitswere determinedon 15 plant samples ineach plot to examinethe characteristics of melon genotypes. Brix value was measured with a digital refractometerto estimate the total soluble solids. In addition, nutrients (N, P, K, Ca, Mg, Fe, Cu, Mn, and Zn) of plant plants were determined in the green parts. Plant nutrient contentswere determined usingthe method explained by Jones (2001) by a Varian Spectra FS220 brand atomic absorption spectrometer. The data were subjected to variance analysis usingthe JMP 13 statistical program according to the randomized blocks experimental design. Significant differences in the mean values fordifferent sowing timeswere determined by Fisher’s Least Significant Difference (LSD) test at a significance level of 0.05.

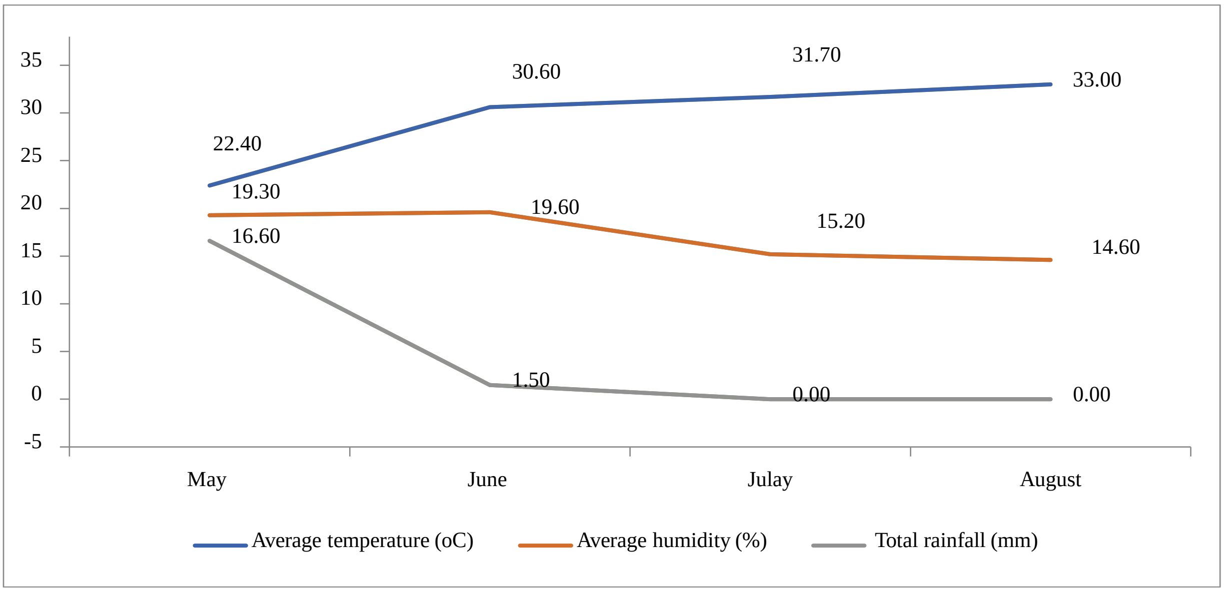

Figure 2. Average temperature (°C), humidity (%) and total rainfall(mm) during the experiment

Results and Discussion

Potassium (K) content (%) of melon plants:

Potassium is very important nutrient for melon and human health, and is considered one of the quality parameters determining the marketing value of fruits and consumer preferences (Lester et al., 2010). The K also significantly affects the concentration of vitamin C, lycopene, beta-carotene and pigments of melon fruits (Ramiérez et al. 2012).The highest Kcontentwas obtainedin May 20 planting treatment with Destari (9.26%) followed by Sagsana (8.47%), Ceriki (6.5%) genotypes, respectively. The lowest Kcontent was obtained in June 15 planting treatment from Sagsana (4.13%) and followed by Destari (4.41%) and Ceriki (3.57%) genotypes, respectively. The results indicated that the highest Kvalue was recordedinlate planting, while the lowest Kvalue was obtained inthe early planting application (Figure 3). The difference inK content between planting times could be attributed to the genetic differences of the genotypes used, environmental factors and the climate change.

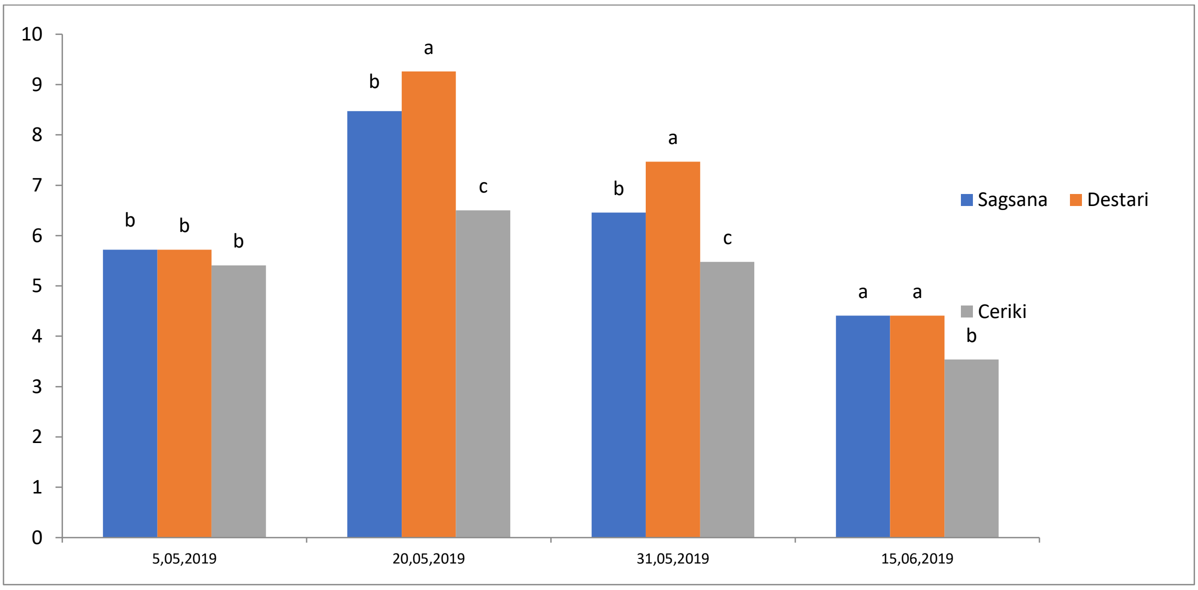

Figure 3. Potassium content of melon leaves (%), LSD test(probability level of 0.05) and LSD values respectively(May5 (1.26), 20 May (0.59), 31 May (0.42) and June 15(0.48)

Phosphorus (P) content(%) of melon plants:

Planting dates of May 5 and 20 had statistically significant effect on P content of melon genotypes, while the effects of planting on May 31 and 15 June were not statistically significant. The highest P content was obtained in May 20 planting treatment from Sagsana and Destari (0.46%) genotypes. The lowest P content was recorded in May 5 planting treatment from Ceriki (0.38%) genotype. The P content of Sagsana genotype planted in May 5 planting date was only 0.38% (Figure 4). Delaying the planting time was proposed an effective method to increase the P content of plants in arid and semi-arid regions (Bar-Yosef, 1999). Roots grow with soil moisture and the nutrients can be concentrated where they are best absorbed by the roots, (Clark et al., 1991).

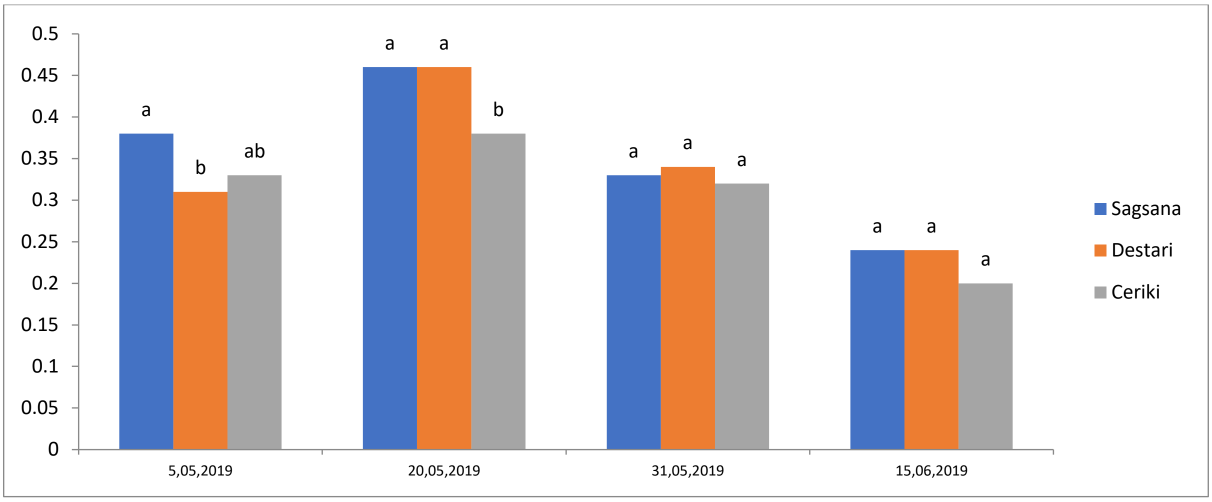

Figure 4. Phosphorus content of melon leaves (%)LSD test(probability level of 0.05) and LSD values respectively(May5 (0.06), 20 May (0.04), 31 May (0.01) and June 15(0.07)

Calcium (Ca) content (%) of melon plants:

Exposure of plant cells to sub-optimum temperatures causes membrane damage. Calcium enhances the heat tolerance of membranes (Starck et al., 1995). The homogenous optimal Ca content in individual plant organs prevents the frequency and severity of physiological disorders caused by adverse external conditions (Poovaiab, 1993; Starck et al., 1995).The Ca content of melon plants in all genotypes decreased with delaying of planting time. Mean Ca content in May 5, 20, 31 and June 15planting times was 2.62, 4.89, 3.72 and2.11%, respectively. The highest Ca content was obtained in Sagsana genotype, and the Mg content was 3.09, 5.43, 4.47 and 2.38% for May 5, 20, 31 and June 15planting times, respectively. The lowest Ca content was recorded in Ceriki genotype with 2.09, 4.62, 3.34 and 1.57% for in May 5, 20, 31 and June 15planting times, respectively (Figure 5).

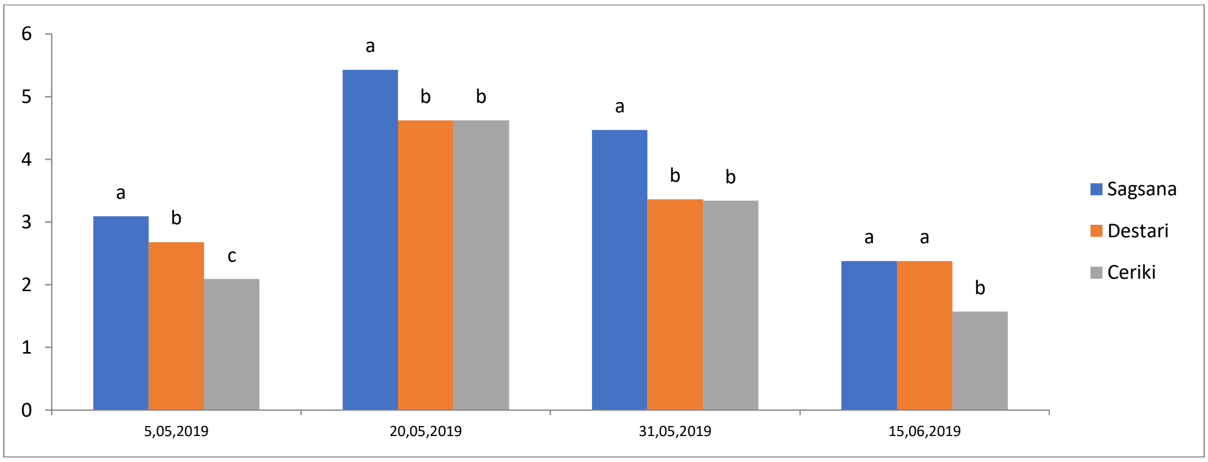

Figure 5. Calcium content of melon leaves (%), LSD test(probability level of 0.05) and LSD values respectively(May5 (0.17), 20 May (0.40), 31 May (0.48) and June 15(0.69)

Magnesium (Mg) content (%) of melon plants:

May 20 was statistically effective on different genotypes and different planting times of the melon plant. Accordingly, 20 May, 31 May and 15 June were not statistically effective. The highest Mg concentration was obtained as Destari (0.46%) from 20 May planting application. The lowest was Ceriki (0.38%). When we look at the Mg concentration in the green part of the melon plant, the averages on different planting dates were determined as May 5 (1.33%), 20 May (0.44%), 31 May (0.41%) and 15 June (0.24%) (Figure 6). Magnesium nutrition is particularly important to ensure that even well-formed tomato fruit ripens. Fruits ripen evenly, but ripening is often delayed.

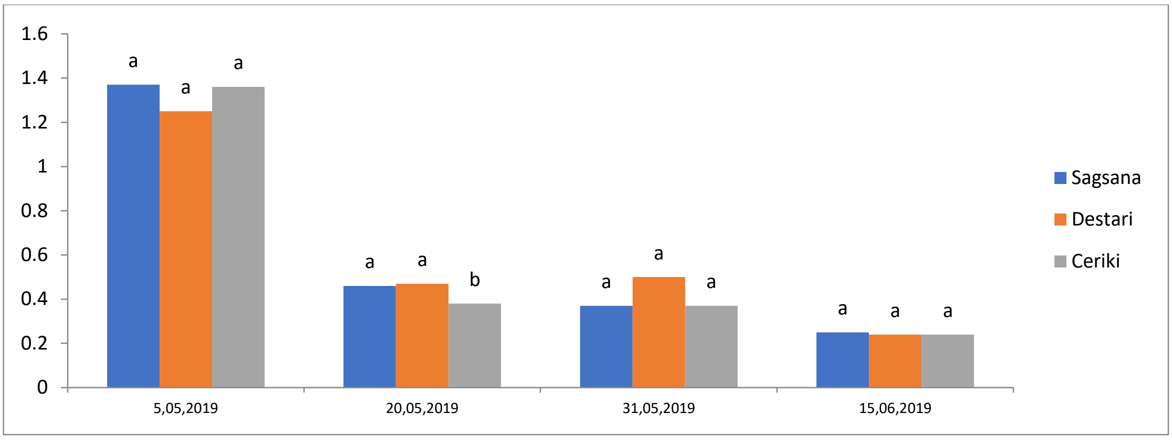

Figure 6.Magnesium content of melon leaves (%), LSD test (probability level of 0.05) and LSD values respectively (May5 (0.27), 20 May (0.04), 31 May (0.14) and June 15 (0.05)

Nitrogen (N) content (%) of melon plants:

Nitrogen content melon plants significantly differed on May 5 and May 31 planting times, while the difference in N content for May 20 and June 15 planting times was not statistically significant (Figure 7). Wahocho et al. (2017) was carried out a study to evaluate the effect of various N applications on economic performance of muskmelon and reported that the highest N fertilizer dose (150 kg ha^{-1}) had a significant positive effect on vegetative traits and produced tallest plants with more branches. The results of our study showed the importance of N fertilizer application on the first planting. In another study, Olaniyi (2008) investigated the effects of individual and combined N and P fertilizer applications on optimum growth and seed yield of *egusi* melon. The growth and seed yield of *egusi* melon have been significantly affected by the various levels of individual and combined N and P fertilizers.

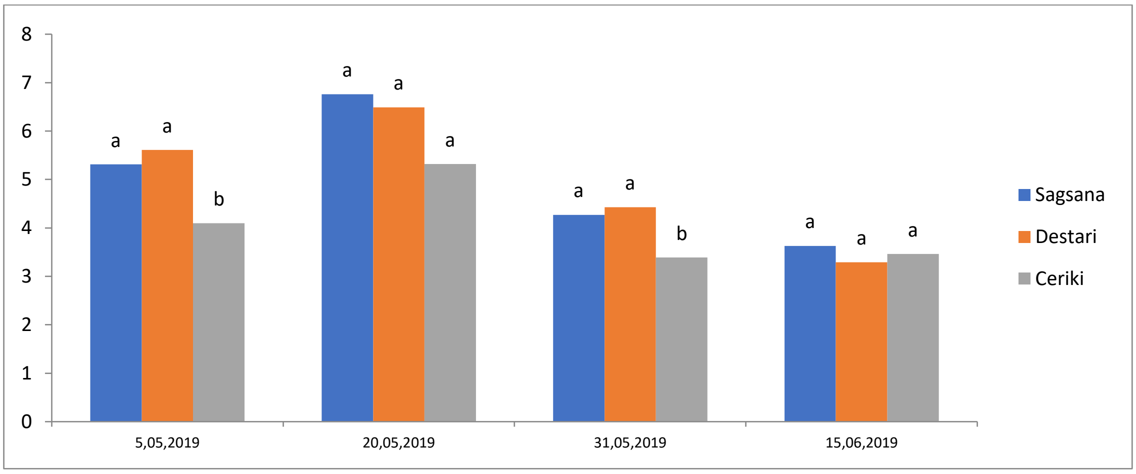

Figure 7.Nitrogen content of melon leaves (%), LSD test (probability level of 0.05) and LSD values respectively (May5 (0.38), 20 May (1.51), 31 May (0.42) and June 15(2.21)

Micro nutrient (Zn, Cu, Fe, Mn) contents (ppm) of melon plants:

The effects of different sowing times on micronutrient contents of melon genotypes were varied depending on melon genotype and sowing time. Micronutrient contents of three different melon genotypes in 4 different sowing times were presented in Figures 8, 9, 10 and 11. Micronutrient contents decreases with the delaying of planting time regardless of melon genotype. The result can be attributed to the increase in temperature with delaying the planting time. Bjelić et al., (2005) reported different Cu contents in tomato plants grown under a wide range of temperatures, humidity and harvest times as well as in greenhouse and open field conditions. The authors concluded that the Cu content of tomatoes are highly stable. Iron is the most abundant micro element in the plant. Iron, which has an important effect on the quality of tomatoes, plays an important role in photosynthesis and respiration as it is involved in metabolic processes. The Fe has also significant role in many enzymatic systems such as chlorophyll synthesis (Houimli et al., 2017). Inactivity or slow transfer throughout the plant (phloem) is characteristic for Fe; thus, the Fe mostly remains in the root and young leaves. This fact was attributed to the low and unstable content of Fe in tomato plants (Bjelić et al., 2005).

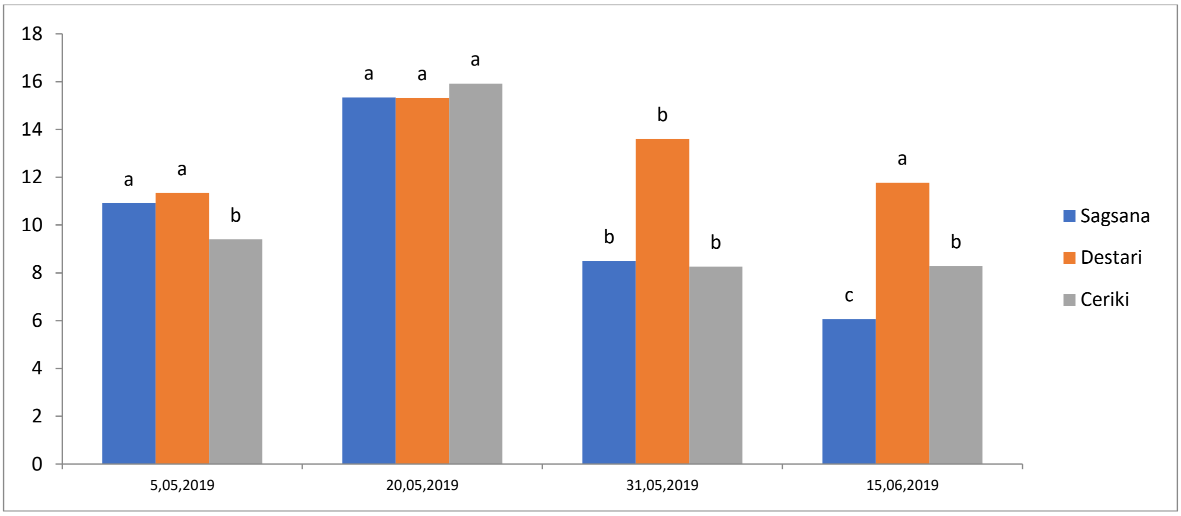

Figure 8.Copper content of melon leaves (ppm), LSD test (probability level of 0.05) and LSD values respectively (May5 (1.34), 20 May (4.52), 31 May (1.02) and June 15(1.01)

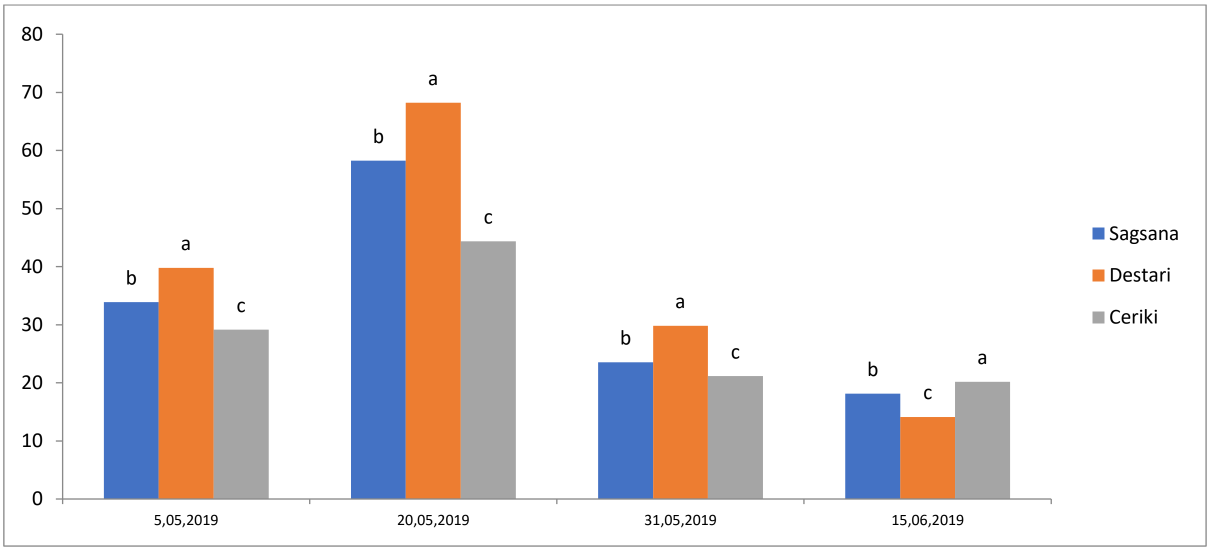

Figure 9. Zinc content of melon leaves (ppm), LSD test (probability level of 0.05) and LSD values respectively(May5 (1.21), 20 May (2.09), 31 May (0.90) and June 15(0.05)

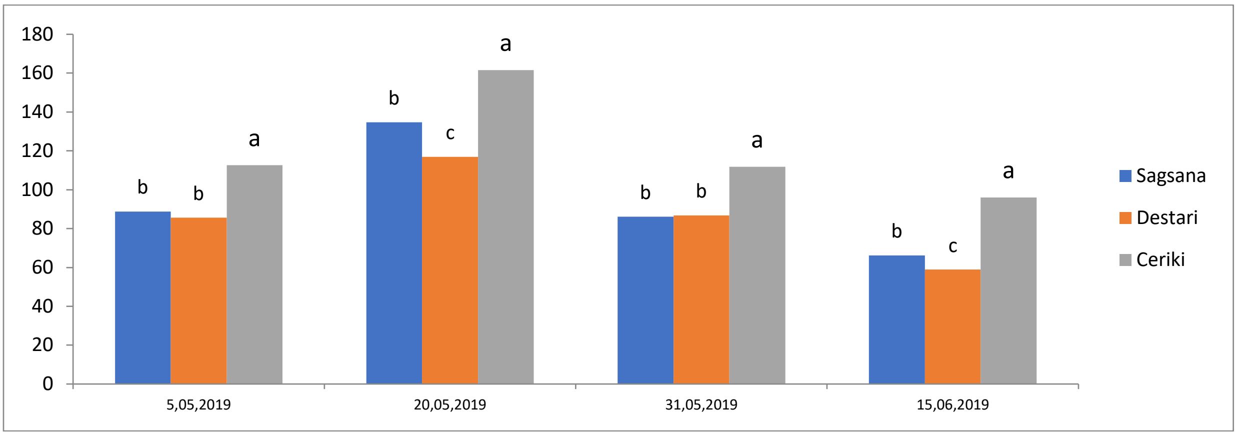

Figure 10. Iron content of melon leaves (ppm), LSD test(probability level of 0.05) and LSD values respectively(May5 (12.09), 20 May (8.14), 31 May (2.50) and June 15 (2.78)

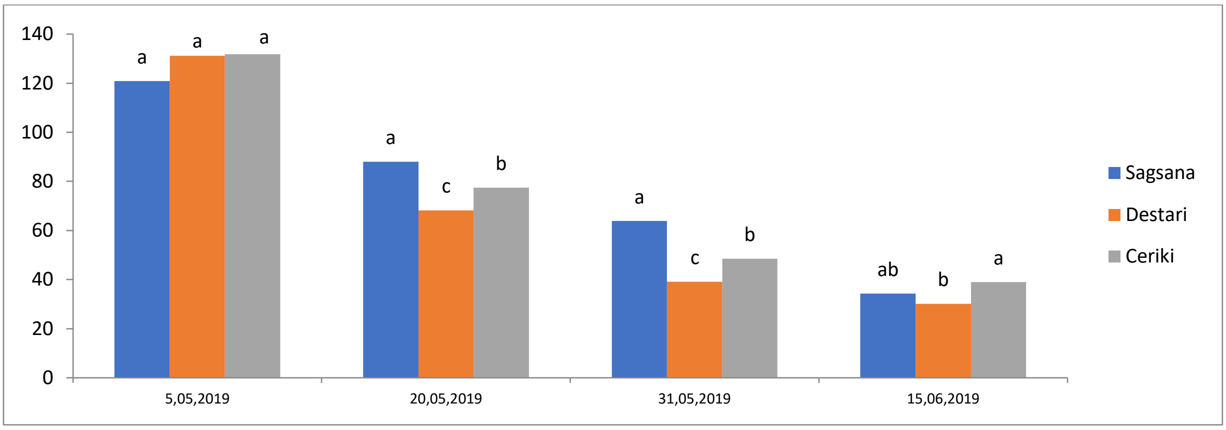

Figure 11. Manganese content of melon leaves(ppm), LSD test(probability level of 0.05) and LSD values respectively(May5 (23.7), 20 May (3.20), 31 May (1.66) and June 15(4.83)

Chlorophyll content (SPAD) of melon plants:

Planting time had significant effect on SPAD measurements of melon genotypes. The SPAD value of melon genotypes significantly differed in May 5 and June 15 planting treatments. The highest SPAD value (83.43)was measured in May 20 planting treatment on Destari genotype. The lowest SPAD value was recorded from Ceriki (56.66). Mean SPAD value of melon genotypes in different planting times was71.66, 78.74, 72.11 and 66.23for May 5, 20, 31 and June 15 (Figure 12).

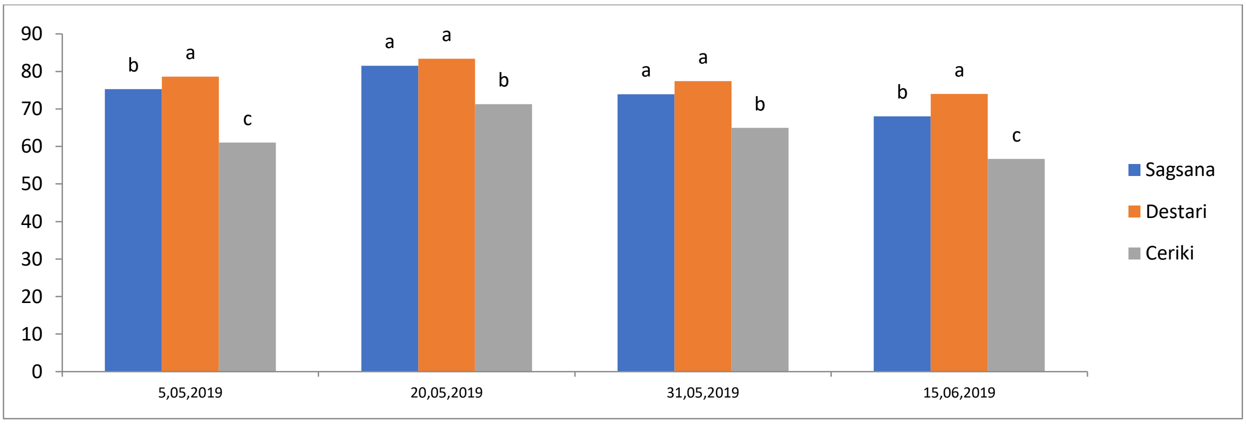

Figure 12. Color density (SPAD) measured for melon genotypes,LSD test (probability level of 0.05) and LSD values respectively(May5 (0.49), 20 May (2.55), 31 May (8.93) and June 15(2.23)

Brix value ofmelon fruits:

The brix value of melon genotypes measured in 4 different planting dates(May 5, May 20, May 31, June 15) were significantly different from each other. The highest brix value (10.98) was recorded on June 15 planting treatment in Sagsana melon genotype. The lowest brix value (7.49) was determined on May 5 planting treatment in Sagsana melon genotype (Figure 13). The results showed that delaying the planting time of melon caused an increase in the brix values of genotypes. The increase in temperature or stress increased the water soluble solids of melon fruit.

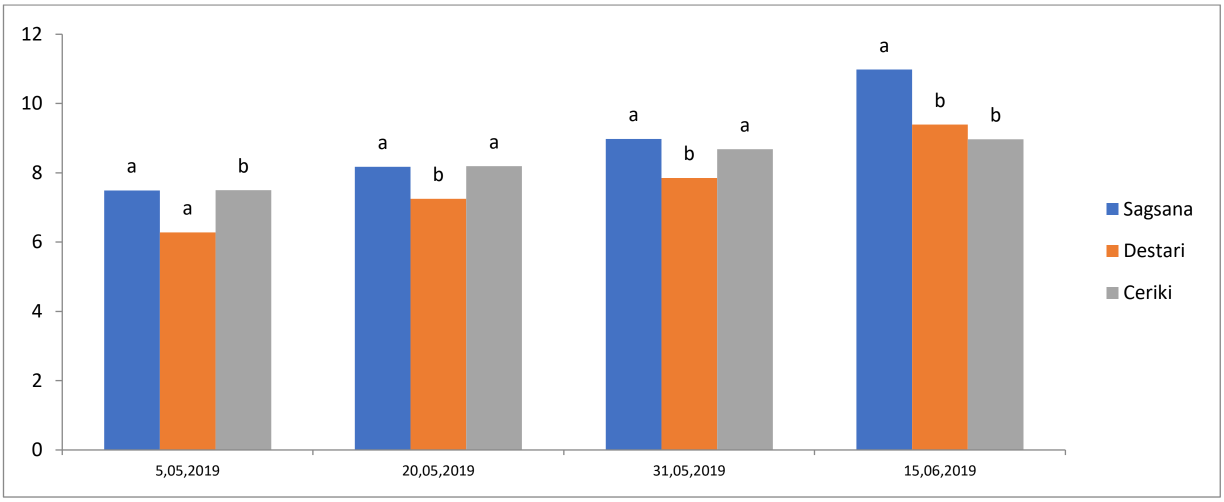

Fig.13. Fruit brix values of melon genotypes, LSD test(probability level of 0.05) and LSD values respectively(May5 (0.44), 20 May (0.29), 31 May (0.66) and June 15(1.44)

Total melon yield (kg da^{-1}):

The highest total yield was recorded in May 20 planting treatment from Destari (3788 kg da^{-1}) and followed by Sagsana (3141 kg da^{-1}) and Ceriki (2429 kg da^{-1}) genotypes, respectively. The lowest total yield was obtained in June 15 planting treatment from Sagsana (2363 kg da^{-1}), Destari (3010 kg da^{-1}) and Ceriki (1647 kg da^{-1}), respectively. The highest mean yield was obtained from late planting application with 3788 kg da^{-1}, while the lowest harvest value was obtained from early planting with2449kg da^{-1} (Figure 14). In a similar study, Ozturk (2019) investigated the effects of four planting times on yield characteristics of two safflower varieties. The results indicated that planting time had significant effect on yield characteristics of safflower plants.

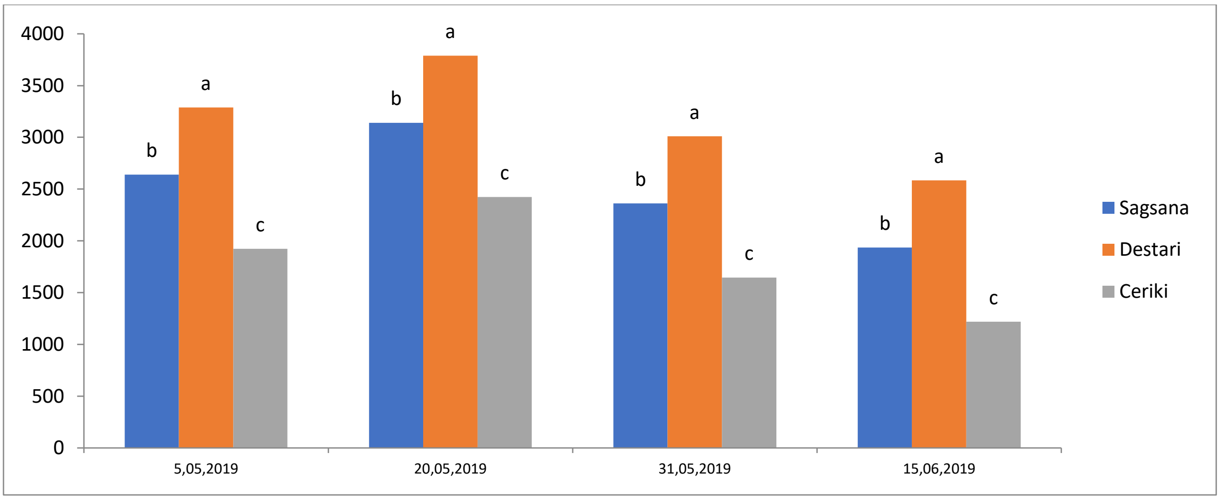

Figure 14. Total melon yield of genotypes (kgda^{-1}), LSD test(probability level of 0.05) and LSD values respectively(May5 (196), 20 May (201), 31 May (184) and June 15(176)

Conclusion

The results of the study revealed that planting in May 20 under ecological conditions of Şırnak province in Turkey should be preferred to obtain high melon yield with rich in nutrient content. The highest melon yield (3788 kg da^{-1}) was obtained from Destari genotype, which had the highest potassium and calcium content. The results concluded that Destari and Sagsana melon genotypes can be successfully grown in semi-arid Şırnak ecological conditions when planted on May 20.

Conflict of Interest Declaration: The authors have no conflict of interest concerned to this work.

Contribution Rate Statement Summary: The authors declare that they have contributed equally to the article.

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