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DETERMINATION OF AGRONOMIC CHARACTERISTICS OF SOME OREGANO GENOTYPES (*ORIGANUM* SP.) IN KAHRAMANMARAŞ CONDITION

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ABSTRACT

Oregano is a valuable essential oil and spice plant from the Lamiaceae family that has a history of thousands of years and was a symbol of nobility, courage and wealth in ancient times. This study was carried out to determine the agronomic characteristics of some oregano genotypes (Origanum sp.) in Kahramanmaras central conditions. The study was established according to the randomized block design with 3 replications using five different oregano genotypes (Denizli 1, Denizli 2, Oguz variety, Origanum majorana L. and Antalya genotype). Plant height, green herba yield, drog herba yield, green leaf ratio, drog leaf ratio, drog leaf yield, the drug leaf/stem ratio and essential oil ratio values were examined in thyme genotypes that underwent the necessary agricultural maintenance and had a year of establishment. In the study, two cuttings were made from thyme genotypes in one season and when the average values of the two cuttings were examined; plant height was determined as 38.02-50.07 cm, total green herb yield was 1158.44-2641.94 kg da^{-1}, drog herb yield was 495.22-917.16 kg da^{-1}, green leaf ratio was 61.40-70.06%, drog leaf ratio was 57.55-63.47 %, drog leaf yield was 134.21-582.40 kg da^{-1}, the drug stem ratio was determined as 36.52-42.44 % and the essential oil ratio was determined as 1.92-4.29%. According to the study results, Antalya genotype stood out in terms of green herb, drug herb and essential oil yield, while Denizli 1 genotype had higher values in terms of essential oil ratio.

Keywords*: Thyme, Origanum, yield, essential oil*

INTRODUCTION

Medicinal and aromatic plants are species known to have been used since ancient and medieval times for a wide range of purposes, including cosmetics, spices, food and pharmaceuticals (Acıbuca, 2018). Historical records indicate that in Ancient Greece, thyme was applied as a nervine sedative in humans, employed as a fumigant to repel insects in homes, and burned as incense in temples. In Ancient Egypt, it was used in the mummification process due to its preservative and antimicrobial properties. It is seen in the prescriptions on ancient tablets

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dating back to the Mesopotamian Civilization period (Bozdemir, 2019). In Türkiye, although the number has varied over the years, approximately 400 plant taxa are traded for medicinal purposes. The rising consumption of medicinal plants has consequently stimulated their agricultural production. Today, around 30 medicinal and aromatic plant species are cultivated in Türkiye; however, despite this progress, the majority of the raw material demanded by the pharmaceutical, food, and cosmetics industries is still imported (Sahin, 2013). Species belonging to the genus *Origanum* are known to originate primarily from the Mediterranean basin, with natural distribution extending through mountainous zones of coastal regions, reaching altitudes of 1200-1500. Within the Turkish spice trade, thyme is among the leading medicinal and aromatic plants. In Turkey, thyme is one of the leading medicinal and aromatic plants in the spice trade. Turkey, a significant source of thyme genetic resources, has high potential not only in the spice sector but also in the global market for essential oils, thyme juice, and other value-added thyme products (Anonymous, 2020). Throughout history, medicinal and aromatic plants have been used for human, plant and animal health through both empirical trial-and-error approaches and, at later stages, increasingly through formal medical practice. Many of the methods regarded today as "alternative medicine" in fact derive from scientifically proven applications established by experts in pharmacy, medicine and molecular biology (Anonymous, 2015). The cultivation area of thyme expanded markedly from 89.137 decares in 2013 to approximately 173.267 decares in 2024, reflecting an increase of nearly 94.38% (Tüik, 2025). Although various species within the Lamiaceae family are colloquially referred to as thyme in Türkiye, those recognized commercially are predominantly the species rich in thymol and carvacrol in their essential oils (Caglayan, 2019). According to ASTA standards, thyme essential oil must contain at least 2%, while the European Pharmacopoeia requires a minimum of 1% (Tuglu et al., 2021). Commercially traded thyme species are expected to have no less than 2.5% essential oil content. Due to its high levels of thymol and carvacrol, thyme oil exhibits strong antibacterial and antifungal activity, and is therefore utilized as a natural food preservative, insect repellent and herbicide (Yaman et al., 2018).

The extensive range of applications and proven bioactivity of thyme has led to a rapidly growing demand, particularly within the pharmaceutical and healthcare sectors in recent years, further reinforcing its strategic importance in global trade (Sokat, 2020). Its relatively low ecological selectivity and ability to thrive under arid conditions are considered significant agronomic advantages. Moreover, increasing global interest in natural products driven by rising epidemics and widespread synthetic drug consumption has further elevated the prominence of thyme. In this study, the present study was conducted to determine the agricultural performance of selected oregano genotypes under the ecological conditions of Kahramanmaraş.

MATERIALS AND METHODS

The experiment was conducted in the research and application field of the Department of Field Crops at Kahramanmaraş Sutcu Imam University (KSU) during the 2020-2021 growing season. The oregano genotypes used in the study, Denizli 1 and Denizli 2, were obtained from oregano growers in Denizli province; the Oguz registered variety was obtained from the Aegean Agricultural Research Institute; the Antalya genotype was obtained from the natural flora; and the *Origanum majorana* species was obtained from Poland. Genotypes other than *Origanum majorana* belong to the species *Origanum onites* L. These genotypes were selected because they are used in oregano cultivation and were tested for the first time under Kahramanmaraş conditions. Seeds of the genotypes studied (Denizli 1, Denizli 2, Oguz variety, *O. majorana*, Antalya genotype) were planted in pots in the KSU greenhouse to obtain seedlings. Once the seedlings reached an appropriate growth stage, they were transplanted into the field on April 22, 2020, following a Randomized Complete Block Design with three replications. The first year was considered the establishment year, and all measurements were taken during the 2021 growing season. Planting was done in four rows, with a parcel width of 3 m and a parcel length of 2 m, and a 1 meter gap was left between the blocks. When planting oregano seedlings in the field, the experiment was set up with a row spacing of 50 cm and a plant spacing of 20 cm, with each plot consisting of 4 rows and a total of 60 plants in each plot. A drip irrigation system was installed for the experiment, and irrigation was carried out at appropriate intervals. At planting, fertilization was applied at a rate equivalent to 6 kg pure nitrogen and 6 kg pure phosphorus per decare. Harvesting was performed when more than 50% of the thyme genotypes had reached the flowering stage. After removing the side effect within each plot, plants were harvested 8-10 cm above the soil surface using a sickle, and then dried in the laboratory under shade conditions. The first harvest took place on June 5, 2021, while the second harvest was performed on September 23, 2021.

Climatic characteristics

Examination of Table 1 shows that the total precipitation recorded in 2021 (746.60 mm) exceeded the long-term average precipitation (721.60 mm).

Table 1. 2021 climate data of Kahramanmaraş Province (Anonymous, 2022a)

Months	Precipitation (mm)		Average Temperature (°C)	
	2021	Long years (1980-2021)	2021	Long years (1980-2021)
January	204.30	124.00	7.00	4.80
February	29.50	112.20	9.30	6.20
March	137.10	95.10	10.40	10.40
April	16.20	73.00	16.60	15.10
May	8.20	38.80	23.50	20.10
June	0.00	8.60	25.50	24.90
July	0.50	2.70	30.30	28.30
August	7.40	2.20	30.00	28.40
September	1.50	11.00	25.10	25.00
October	3.30	45.40	19.70	18.90
November	34.20	78.00	13.80	11.80
December	304.40	130.60	7.50	6.60
Total	746.60	721.60	-	-
Average	-	-	18.23	16.71

Considering the temperature values, the mean temperature recorded in 2021 (18.23 °C) was higher than the long-term average (16.71 °C), and the growing season was characterized by a markedly dry summer (Table 1).

Soil characteristics

The soil sample taken from the 0–30 cm depth of the experimental area was classified as moderately calcareous (2.28%), non-saline (0.15%), clay-loam in texture (69.96%), low in organic matter content (1.55%), sufficient in potassium (K_2O) (42.65 kg da^{-1}), yet very low in available phosphorus (P_2O_5) (4.55 kg da^{-1}).

Measurements and observations

Plant height (cm): In each plot, 10 normally developing plants were selected and the distance from the soil level to the top was measured and the average was taken (Avcı, 2006).

Fresh herbage yield (kg da^{-1}): After removing the plot side effect, the remaining plants were determined by mowing with a sickle 8-10 cm above the soil level and weighing them fresh (Avcı, 2006).

Fresh leaf ratio (%):It was found by calculating the percentage of the weighing results of the leaves separated from the stems by separating the leaves from the stems from 500 g of sample taken from each plot at harvest (Arabacı, 1995).

Dry herbage yield (kg da^{-1}): It was obtained by multiplying the green herb yield by the drug herb ratio and dividing the result by 100 (Avcı, 2006).

Dry leaf ratio (%):It was determined by separating the leaf and stem in the dried sample, weighing the leaves and taking their percentage (Avcı, 2006).

Dry leaf yield (kg da^{-1}): It was determined by multiplying the herb yield by the drug leaf ratio and dividing by 100 (Avcı, 2006).

Dry stem ratio (%):The samples used in fresh stem weight were dried in a drying cabinet at 30 ^{o}C and the weight was expressed as a percentage (Arslan, 2014).

Essential oil content (%): In dried plant samples, leaves were separated from stems, and essential oil content was determined from the leaf portion using a Neo-Clevenger apparatus (Avcı, 2006).

Data analysis

All recorded data were evaluated according to the Randomized Complete Block Design using the JMP Pro 13 statistical software. Significant differences were further compared using the LSD multiple comparison test at the 5% probability level ($P < 0.05$).

RESULTS AND DISCUSSION

In this study, regarding plant height, the lowest values across both harvests and genotype mean comparisons were obtained from the *Origanum majorana* species. In the first harvest, no significant differences in plant height were observed among the genotypes except for *O. majorana*.

Table 2. Average values of plant height and essential oil content of the genotypes used in the study

Genotype	Plant height (cm)			Essential oil content (%)		
	1. Harvest	2. Harvest	Genotype Av.	1. Harvest	2. Harvest	Genotype Av.
Denizli 1	57.40 a	35.40 b	46.40 b	5.05 a	2.26 d	3.66 b
Denizli 2	57.90 a	36.16 b	47.03 b	4.37 bc	2.60 c	3.48 b
Oguz variety	57.73 a	37.13 ab	47.43 ab	4.52 b	4.06 a	4.29 a
O. majorana	45.02 b	31.03 c	38.02 c	2.11 d	1.73 e	1.92 c
Antalya	60.51 a	39.63 a	50.07 a	3.93 c	3.58 b	3.75 b
Harvest Av.	55.71	35.87	45.79	3.99	2.84	3.42
LSD (5%)	3.18**	3.34**	2.90**	0.51**	0.31**	0.31**

Considering the mean values of the second harvest and the overall genotype means, the greatest plant height was recorded in the Antalya genotype. In the *Oregano* genotypes grown, plant height ranged from 45.02 to 60.51 cm in the first harvest and 31.03 to 39.63 cm in the second harvest, shows that there is a significant difference between harvest periods. The overall genotype means of both harvests varied between 38.02 and 50.07 cm. When compared with findings from previous studies, Avcı (2006) reported plant heights of 16.20-38.17 cm, Ataman (2023) 45.3-58.7 cm, Tekin (2005) recorded 47.6 cm in the first and 25.9 cm in the second harvest, Güngör (2005) 22.9-32.5 cm, while Koç (2025) reported 31.6-45.6 cm. The plant height values obtained in the present study were higher than those reported by Avcı (2006), Koç (2025) and Güngör (2005), and comparable to the results of Tekin (2005) and Ataman (2023). This difference between plant height values is thought to be due to differences in climatic conditions, genotypes used and agricultural practices.

In terms of essential oil content, the lowest mean value across both harvests and genotype averages was observed in *Origanum majorana*. The highest value in the first harvest was obtained from the Denizli1 genotype, while in the second harvest as well as based on genotype means the Oguz cultivar exhibited the highest essential oil percentage. Essential oil content in the studied Oregano genotypes ranged from 2.11 % to 5.05 % in the first harvest, 1.73 % to 4.06 % in the second harvest, and 1.92 % to 4.29 % across genotype means. When looking at similar studies; Tekin (2005) reported the essential oil content as 1.88% in the first form and 1.59% in the second form, Koç (2025) as 3.0-4.6%, Ataman (2023) as 5.90-9.21%, Sonkaya (2019) as 2.11-4.41%. The essential oil content values obtained in this study were determined to be similar to those of Tekin (2005), Koç (2025) and Sonkaya (2019), but lower than Ataman (2023) (Table 2).

Table 3. Average values of fresh herb yield and fresh leaf ratio of genotypes used in the study

Genotype	Fresh herb yield (kg da^{-1})			Fresh leaf yield (kg da^{-1})		
	1. Harvest	2. Harvest	Genotype Av.	1. Harvest	2. Harvest	Genotype Av.
Denizli 1	1211.16 b	476.94 c	1688.11 c	56.00 b	66.80 b	61.40 b
Denizli 2	1380.83 b	751.66 b	2132.49 b	56.53 b	68.80 b	62.66 b
Oguz variety	1602.50 a	1039.44 a	2641.94 a	60.53 a	79.60 a	70.06 a
O. majorana	717.33 c	441.10 c	1158.44 d	61.06 a	66.93 b	64.00 b
Antalya	1753.66 a	1019.54 a	2773.21 a	51.46 c	79.33 a	65.40 b
Harvest Av.	1333.29	745.73	2078.83	57.11	72.29	64.70
LSD (5%)	201.40**	108.71**	255.05**	2.42**	6.84**	4.32**

According to Table 3, the lowest fresh herbage yield across both harvests and based on the mean of genotypes was obtained from *O. majorana*. The highest fresh herbage yield in both harvests and total yield was obtained from the Oguz variety and the Antalya genotype. Among the cultivated oregano genotypes, fresh herbage yield ranged from 717.33 to 1753.66 kg da^{-1} in the first harvest, 441.10 to 1039.44 kg da^{-1} in the second harvest, and total fresh herbage yield varied between 1158.44 and 2773.21 kg da^{-1}. In previous studies, total fresh herbage yield was reported as 2632.49–2808.13 kg da^{-1} by Sancaktaroglu (2010), 1240.3–1243.7 kg da^{-1} by Koç (2025), 1219–2375.8 kg da^{-1} by Ataman (2023), 373.3–1958.3 kg da^{-1} by Avcı (2006), 1381.7 kg da^{-1} (first cut) and 1199.4 kg da^{-1} (second cut) by Tekin (2005), 520.0–766.7 kg da^{-1} by Güngör (2005), 1045.4 kg da^{-1} by Kırman (1993), 222.45–714.63 kg da^{-1} by Sonkaya (2019), 834.3 kg da^{-1} by Ay (2005), and 1712–5274 kg da^{-1} by Bağdat (2011). The fresh herbage yields obtained in the present study were lower than those reported by Ataman (2023) and Bağdat (2011), comparable to the findings of Sancaktaroğlu (2010), Koç (2023) and Tekin (2005), and higher than the values reported by Avcı (2006), Kırman (1993), Sonkaya (2019), Ay (2005) and Güngör (2005). These variations among studies are likely associated with differences in cultivars and genotypes used, ecological conditions, or agricultural practices.

Regarding leaf ratio, the lowest value in the first harvest was recorded in the Antalya genotype, whereas the highest values were observed in the Oguz cultivar and *O. majorana*. In the second harvest, the lowest leaf ratios were obtained from Denizli-1, Denizli-2 and *O. majorana*, while the highest values were again found in the Oguz cultivar and Antalya genotype. Based on the mean of the two harvests, all genotypes except Oguz variety were placed into the same statistical group and exhibited comparatively lower leaf ratios. In the oregano genotypes evaluated, leaf ratio ranged from 51.46 % to 61.06 % in the first harvest, 66.80 % to 79.33 % in the second harvest, and 61.40 % to 70.06 % in the genotype means (Table 3).

Table 4. Average values of dry herb yield and dry leaf yield of genotypes used in the study

Genotype	Dry herb yield (kg da^{-1})			Dry leaf yield (kg da^{-1})		
	1. Harvest	2. Harvest	Genotype Av.	1. Harvest	2. Harvest	Genotype Av.
Denizli 1	384.66 c	110.55 c	495.22 c	222.75 c	63.34 c	286.09 c
Denizli 2	447.66 b	183.60b	631.27 b	264.72 bc	102.73b	367.45 b
Oguz variety	551.33 a	365.83 a	917.16 a	346.78 a	235.62 a	582.40 a
O. majorana	162.86 d	59.71 d	222.58 d	97.23 d	36.98 d	134.21 d
Antalya	576.33 a	361.52 a	937.85 a	299.46 ab	240.82 a	540.29 a
Harvest Av.	42.45	216.24	640.81	246.18	135.95	382.08
LSD (5%)	55.96**	33.38**	85.79**	50.10**	20.75**	65.95**

In the oregano genotypes evaluated, dry herb yield ranged from 162.86 to 576.33 kg da^{-1} in the first harvest, 59.71 to 365.83 kg da^{-1} in the second harvest, and from 222.58 to 937.85 kg da^{-1} based on genotype means. The lowest values across both harvests and for total dry herbage yield were recorded in *O. majorana*. In contrast, the highest yields in both individual harvest and in total were obtained from the Oguz cultivar and the Antalya genotype (Table 4). In comparison with previous research, drug herbage yield has been reported as 912.16–1074.53 kg da^{-1} by Sancaktaroğlu (2010), 729.1–815.3 kg da^{-1} by Koç (2025), 369.7–738.3 kg da^{-1} by Ataman (2023), 131.9–631.3 kg da^{-1} by Avcı (2006), 473.9 kg da^{-1} in the first and 428.7 kg da^{-1} in the second harvest by Tekin (2005), 269.9–803.3 kg da^{-1} by Güngör (2005), 269.1 kg da^{-1} by Kaçar et al. (2006), 357.3 kg da^{-1} by Kırman (1993), 64.30–256.74 kg da^{-1} by Sonkaya (2019), 483–1537 kg da^{-1} by Bağdat (2011), and 230.5 kg da^{-1} by Baydar (2002).

Regarding dry leaf yield, the lowest mean values across both harvests and genotype means were also obtained from *O. majorana*. The highest leaf dry yield in the first harvest was produced by the Oguz cultivar, whereas in the second harvest and based on genotype means, the Oguz cultivar and the Antalya genotype showed the highest values. In the oregano genotypes studied, dry leaf yield ranged from 97.23 to 299.46 kg da^{-1} in the first harvest, 39.98 to 240.82 kg da^{-1} in the second harvest, and from 134.21 to 540.29 kg da^{-1} based on genotype means (Table 4). Previous studies have reported dry leaf yields of 539.24 and 676.95 kg da^{-1} by Sancaktaroğlu (2010), 496.3–527.3 kg da^{-1} by Koç (2025), 369.7–738.3 kg da^{-1} by Ataman (2023), 408.4–953.4 kg da^{-1} by Avcı (2006), 222.8 kg da^{-1} (first harvest) and 314.5 kg da^{-1} (second harvest) by Tekin (2005), 176.6–536.7 kg da^{-1} in the first and 129.0–439.0 kg da^{-1} in the second harvest by Güngör (2005), 180 kg da^{-1} by Kaçar et al. (2006), and 257.5 kg da^{-1} by Kırman (1993). The dry leaf yields obtained in the current study were lower than those reported by Sancaktaroğlu (2010), Ataman (2023), Koç (2025), Avcı (2006) and Güngör (2005), comparable to the results of Kırman (1993) and Tekin (2005), and higher than those reported by Karagöz (2018) and Kaçar et al. (2006).

Table 5. Average values of dry leaf ratio and dry stem ratio of genotypes used in the study

Genotype	Dry leaf ratio (%)			Dry stem ratio (%)		
	1. Harvest	2. Harvest	Genotype Av.	1. Harvest	2. Harvest	Genotype Av.
Denizli 1	58.16 a	57.72 bc	57.94	41.83	42.20 a	42.05 ab
Denizli 2	59.16 a	55.96 c	57.55	40.84	44.03 a	42.44 a
Oguz variety	62.67 a	64.28 a	63.47	37.32	37.71 b	36.52 c
O. majorana	59.74 a	61.87 ab	60.81	40.25	38.12 b	39.18 abc
Antalya	51.97 b	64.98 a	58.47	45.52	31.37 c	38.45 bc
Harvest Av.	58.34	60.96	59.64	41.15	38.68	39.72
LSD (5%)	5.16**	5.43*	4.32	5.00	3.15**	3.66**

In terms of dry leaf ratio, all genotypes except for Antalya were statistically grouped together in the first harvest, with the Antalya genotype exhibiting the lowest leaf ratio. In the second harvest, the Denizli-2 genotype recorded the lowest dry leaf ratio, whereas the Antalya genotype and the Oguz cultivar showed the highest ratios. Across the oregano genotypes evaluated, drug leaf ratio ranged from 51.97 % to 62.67 % in the first harvest, 55.96 % to 64.98 % in the second harvest, and 57.55 % to 63.47 % based on genotype means (Table 5). Regarding dry stem ratio, no significant differences were

observed among genotypes in the first harvest. However, the second harvest showed significance at the 1 % level, and the mean of harvests was found to be statistically significant at the 5 % level. According to Table 5, the lowest stem ratio in the second harvest was obtained from the Antalya genotype, while the highest values were found in the Denizli-1 and Denizli-2 genotypes. Based on harvest means, the highest dry stem ratio was recorded in Denizli-2, whereas the lowest value belonged to the Oguz cultivar. In the oregano genotypes examined, dry stem ratio varied from 37.32 % to 45.52 % in the first harvest, 31.37 % to 44.03 % in the second harvest, and from 36.52 % to 42.44 % in the genotype means.

CONCLUSION

This study was conducted during the 2020-2021 growing seasons to evaluate the agronomic performance of selected Origanum genotypes under the ecological conditions of Kahramanmaraş central province.

In the oregano genotypes used in the study, no differences were observed in plant height values except for *O. majorana*. Since *O. majorana* exhibits a structure that develops laterally, it has a lower plant height value than the other genotypes. In terms of fresh leaf yield, the Oguz registered variety had a higher value than other oregano genotypes. In terms of dry leaf yield, the Oguz registered variety and the Antalya genotype were found to be in the same statistical group and had the highest values.

Considering yield and quality parameters, the Antalya genotype was found to be superior in terms of fresh herbage, dry herbage and essential oil yield, while the Denizli-1 genotype exhibited the highest essential oil content. The findings clearly indicate that oregano species belonging to the genus Origanum can be cultivated with ease and high adaptation potential under the central Kahramanmaraş ecological conditions.

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