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RESEARCH ARTICLE

Determination of Some Quality Characteristics of the Coriander (*Coriandrum sativum* L.) Plant Grown in Different Locations

Furkan Coban[1]✉ • Péter Radácsi[2]

[1]Atatürk University, Faculty of Agriculture, Department of Field Crops, Erzurum/Türkiye
[2]Hungarian University of Agriculture and Life Sciences, Institute of Horticultural Sciences, Department of Medicinal and Aromatic Plants, Budapest/Hungary

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ABSTRACT

This study examined how ecological variation influences key quality traits of coriander (*Coriandrum sativum* L.). The research was conducted under two contrasting environments, referred to here as the Türkiye (Erzurum) and the Hungary location (Budapest), using the Gürbüz cultivar at both sites. Seed oil content was significantly higher at the Türkiye location (25.82%), whereas protein content did not differ significantly between locations. In terms of mineral composition, seeds from the Türkiye location contained higher concentrations of potassium, calcium, and zinc, while phosphorus levels were higher at the Hungary location. Fatty acid analysis showed that petroselinic acid, a compound of notable industrial value, was more abundant at the Türkiye location (72.24%), whereas linoleic acid content was higher at the Hungary location (21.27%). Although total unsaturated fatty acids remained high at both locations, the relative proportions of individual fatty acids varied, indicating that local climatic and edaphic conditions shape the nutritional and biochemical composition of coriander.

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1. Introduction

Coriander (*Coriandrum sativum* L.), a member of the Apiaceae family, is a medicinal, aromatic, and economically valuable plant (Diederichsen et al., 2020). As an annual species capable of adapting to diverse climatic and soil conditions, coriander is cultivated across a wide geographical range (López et al., 2008). Having a long history of cultivation in regions such as the Mediterranean, Southern Europe, Anatolia, and the Caucasus, it is now widely grown in many parts of the world, including India, Pakistan, Iran, Turkey, Mexico, Canada, and several European countries (Horn et al., 2023; Sahib et al., 2013).

Coriander is utilized for both its fresh leaves and dried seeds. Its dried fruits are commonly employed as a spice and flavoring agent in a variety of products, including sauces, chocolates, meat products, bakery goods, and confectionery (Bhat et al., 2014; Devi et al., 2020). Additionally, coriander is a key ingredient in many curry blends in gastronomy (Datta et al., 2015). The fruits are particularly valued for their content of essential oils and fatty oils. Coriander seeds typically contain

✉ Correspondence
E-mail address: furkan.coban@atauni.edu.tr

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about 25% fixed oil and less than 1% essential oil (Mandal & Mandal, 2015). The fixed oil, which is light yellow in color and has a distinctive aroma, is notable for its high content of petroselinic acid (C18:1n-12). The unique positioning of the double bond in this fatty acid (Δ6,7) differentiates it from more common fatty acids and makes it a valuable precursor in the biosynthesis of compounds such as lauric and adipic acids, which are used in the production of detergents, plastics, nylon, and surfactants (Ramadan & Mörsel, 2002). The concentration of petroselinic acid varies widely, ranging from 65.7% to 84.2%, depending on geographic origin and ecological conditions. In addition to petroselinic acid, coriander seed oil contains 13.0-16.7% linoleic acid (C18:2), 4.4-6.8% oleic acid (C18:1n-9), and smaller amounts of saturated fatty acids such as palmitic (C16:0) and stearic acid (C18:0) (Sahib et al., 2013; Sriti et al., 2011).

The seeds of *Coriandrum sativum* L. have been widely used in traditional medicine to alleviate various health issues, including digestive disorders, flatulence, rheumatism, colds, and joint pain (Nadeem et al., 2013). In recent years, scientific studies have increasingly supported these traditional uses by demonstrating that coriander possesses a broad spectrum of pharmacological activities. Experimental research has revealed that the plant exhibits analgesic (Chaudhry & Tariq, 2006), anthelmintic (Eguale et al., 2007), antibacterial (Silva et al., 2011), antioxidant (Msaada et al., 2017), anti-inflammatory (Sari et al., 2021), hypoglycemic, hypolipidemic (Aissaoui et al., 2011), anxiolytic (Emamghoreishi et al., 2005), sedative (Gastón et al., 2016), and antitumor (Chang et al., 2022) effects. Beyond its therapeutic properties, coriander is also recognized as a valuable raw material in industrial applications, such as soap production and food flavoring. Moreover, the hepatoprotective effects of coriander seed extracts against carbon tetrachloride (CCl_4)-induced liver damage, along with their ability to enhance insulin secretion in pancreatic beta cells, highlight the plant's significant potential in the management of metabolic disorders (Mahleyuddin et al., 2021; Sreelatha et al., 2009).

One of the key contributors to this multifaceted therapeutic potential is the presence of various micro- and macroelements. These elements, essential for maintaining human health and regulating fundamental metabolic functions, enhance the nutritional and pharmacological value of the plant. Macro-elements such as magnesium (Mg) and calcium (Ca) play critical roles in muscle contraction, nerve transmission, bone health, and energy metabolism (Palai et al., 2025; Yadav et al., 2024). Meanwhile, microelements including iron (Fe), zinc (Zn), manganese (Mn), and copper (Cu) are involved in oxygen transport, enzymatic activities, immune system function, and antioxidant defense mechanisms (Hänsch & Mendel 2009; Nieder et al., 2018). In this context, medicinal and aromatic plants have gained increasing importance not only as functional food components but also as complementary dietary sources due to their elemental composition. Indeed, both the leaves and seeds of *Coriandrum sativum* L. contain varying levels of elements such as magnesium, iron, manganese, zinc, and copper (Nadeem et al., 2013).

The development of medicinal and aromatic plants is dynamically influenced by environmental factors such as temperature fluctuations, light intensity, and soil characteristics (Abdelmajeed et al., 2013; Turanlı et al., 2025). These ecological constraints affect the physiological and biochemical responses of plants, altering both the synthesis of secondary metabolites and the overall nutritional composition. In light of this, the present study aims to determine the protein and oil content, fatty acid composition, and macro and microelement profiles of *Coriandrum sativum* L. grown in different locations, thereby evaluating the impact of varying ecological conditions on these key quality parameters.

2. Materials and Methods

This study was conducted to evaluate the ecological performance of coriander (*Coriandrum sativum* L.) under contrasting environmental conditions and was carried out during the 2018 growing season at two geographically distinct locations. Field experiments in Türkiye were established at the Plant Production Application and Research Center of Atatürk University in Erzurum (39°90′56″ N, 41°26′58″ E), situated at an altitude of 1787 m above sea level. The second experimental site was located at the research station of the Hungarian University of Agriculture and Life Sciences (MATE) in Budapest (47°39′88″ N, 19°14′92″ E), at an elevation of 108 m (Figure 1). The cultivar "Gürbüz", used consistently at both locations, is a registered variety in Türkiye and is characterized by a high yield potential.



Figure 1. Location of the experimental fields in Erzurum (Türkiye) and Budapest (Hungary).

During the vegetation period of the experiment, climatic data were recorded for both locations. In Budapest, total monthly precipitation reached 228.4 mm in May and 109.8 mm in July. In Erzurum, precipitation remained comparatively low throughout the growing season, with only 3 mm recorded in July. At the beginning of the growing season, mean temperatures in Budapest were 12.7 °C in April and increased to 22.7 °C in June. In Erzurum, the growing season began with a mean temperature of 11.9 °C in May, and temperatures gradually increased to 20.3 °C in August.

Soil samples were collected from both experimental fields prior to sowing and analyzed for physicochemical properties. The Budapest soil had a slightly acidic reaction (pH 6.49), salinity of 0.039%, and humus content of 1.17%. Available phosphorus (P_2O_5) was 291 mg kg^{-1} and potassium (K_2O) was 36.7 mg kg^{-1}. The soil contained Fe (109 mg kg^{-1}), Mn (37.8 mg kg^{-1}), Zn (1.73 mg kg^{-1}), Cu (3.47 mg kg^{-1}), Mg (53 mg kg^{-1}), Ca (0.489%), NO_3-N (1.24 mg kg^{-1}), and $CaCO^3$ below 1%. The Erzurum soil was classified as clay-loam, containing 35.78% clay, 29.50% silt, and 34.72% sand. Soil pH was 7.56, organic matter content was 1.01%, and $CaCO_3$ was 1.14%. Available phosphorus was 4.41 kg P_2O_5 da^{-1}, and potassium was 171 kg K_2O da^{-1}.

The experiment was established at both locations using a Randomized Complete Block Design (RCBD) with three replications. Sowing was carried out on 06 May at the Erzurum location and on 02 April at the Budapest site, while harvesting was completed on 08 September in Erzurum and on 13 August in Budapest. Sowing was performed manually at both locations, with a row spacing of 30 cm. Each experimental plot measured 5.0 m x 1.2 m.

Fertilization practices were standardized across locations, with applications equivalent to 40 kg N ha^{-1} and 60 kg P ha^{-1}. Crop management practices varied between sites according to local conditions. At the Erzurum location, weed control was conducted three times and plots were irrigated twice during the growing season. In contrast, weed control and irrigation were each applied twice at the Budapest location.

Seeds harvested from the Budapest location were transported to the Erzurum location. To ensure analytical comparability and sample homogeneity, quality analyses of seed samples obtained from both locations were conducted under identical laboratory conditions. All analyses were performed at the Eastern Anatolia High Technology Application and Research Center (DAYTAM).

Seed protein content was determined by the Kjeldahl method using an automated analyzer in accordance with AOAC Official Method 979.06 (AOAC, 2000), in which 1.0 g of sample was digested with concentrated H_2SO_4 in the presence of $CuSO_4 \cdot 5H_2O$-K_2SO_4 catalyst, followed by ammonia distillation and titration with 0.2 N HCl. Crude oil content was measured by Soxhlet extraction according to AOAC Official Method 920.39 (2000) using diethyl ether as the solvent. Macro- and microelement concentrations were quantified after microwave-assisted wet digestion following USEPA Method 3052 and subsequent analysis by ICP-MS (Agilent 7800). Fatty acid composition was determined as fatty acid methyl esters (FAMEs) prepared with 2 N KOH in methanol according to IUPAC Method 2.301 (Dieffenbacher & Pocklington, 1992) and analyzed by GC-MS (Agilent 7890A/5975C) using a BPX90 capillary column, with compound identification based on retention times compared to a certified standard.

Statistical analyses and data visualization were performed using R (version 2025.05.0+496; Posit Software). Descriptive statistics, including means and standard deviations, were calculated for all measured variables such as protein, oil contents, fatty acid composition, and mineral concentrations. Differences between the two cultivation locations (Türkiye and Hungary) were evaluated using independent-samples t-tests, and statistical significance was determined at $p < 0.05$.

3. Results

3.1. Influence of Location on Oil and Protein Content

The research findings indicate that the cultivation site played a decisive role in the oil content of the seeds. Seeds produced at the Türkiye location had the highest oil content (25.82%), whereas it decreased to 20.64% at the Hungary location. Regarding the protein content, no statistically significant difference was observed between the two locations. However, seeds obtained from the Hungary location showed a trend toward higher protein levels at 14.2%, compared to 12.4% recorded in Türkiye (Figure 2).

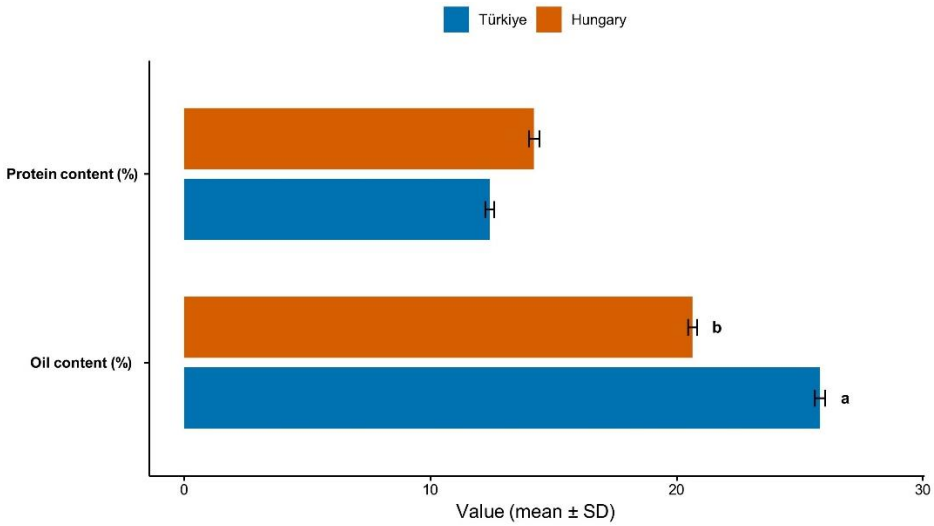


Figure 2. Protein and oil contents of coriander seeds grown in Türkiye and Hungary. Different letters indicate significant differences at $p < 0.05$.

3.2. Variation in Mineral Composition

Mineral composition in the seeds of the Gürbüz coriander cultivar exhibited significant variations at both macro and micro-element levels, depending on the cultivation site (Figure 3). The influence of the location was particularly pronounced and statistically significant regarding the content of phosphorus (P), potassium (K), calcium (Ca), and zinc (Zn). In terms of phosphorus, the Hungary location (938.73 mg $100g^{-1}$) showed a higher accumulation potential compared to the Türkiye location (785.86 mg $100g^{-1}$). Conversely, an opposite trend was observed for potassium and calcium levels; seeds harvested in Türkiye, with values of 1816.45 mg $100g^{-1}$ for potassium and 626.58 mg $100g^{-1}$ for calcium, significantly exceeded those from the Hungary location (1478.15 and 259.56 mg $100g^{-1}$, respectively). The most striking regional divergence was recorded in zinc (Zn) content; while zinc concentrations reached 65.64 mg $100g^{-1}$ in seeds from the Türkiye location and 2.37 mg $100g^{-1}$ in the Hungary location (Figure 3).

On the other hand, differences between the locations regarding magnesium (Mg), manganese (Mn), iron (Fe), and copper (Cu) content did not reach statistical significance ($p > 0.05$). Despite the lack of statistical differentiation, an evaluation of the numerical data indicated that magnesium (493.33 mg $100g^{-1}$), manganese (8.23 mg $100g^{-1}$), iron (49.79 mg $100g^{-1}$), and copper (1.61 mg $100g^{-1}$) levels in the Hungary location were numerically higher than the magnesium (434.31 mg $100g^{-1}$), manganese (4.30 mg $100g^{-1}$), iron (30.69 mg $100g^{-1}$), and copper (1.43 mg $100g^{-1}$) values recorded in Türkiye location. These findings suggest that while soil properties and regional microclimatic conditions play a decisive role in the specific mineral profile of the coriander, the accumulation capacity of certain elements (Mg, Mn, Fe, and Cu) remains more resilient to environmental fluctuations, likely due to stronger genetic control (Figure 3).

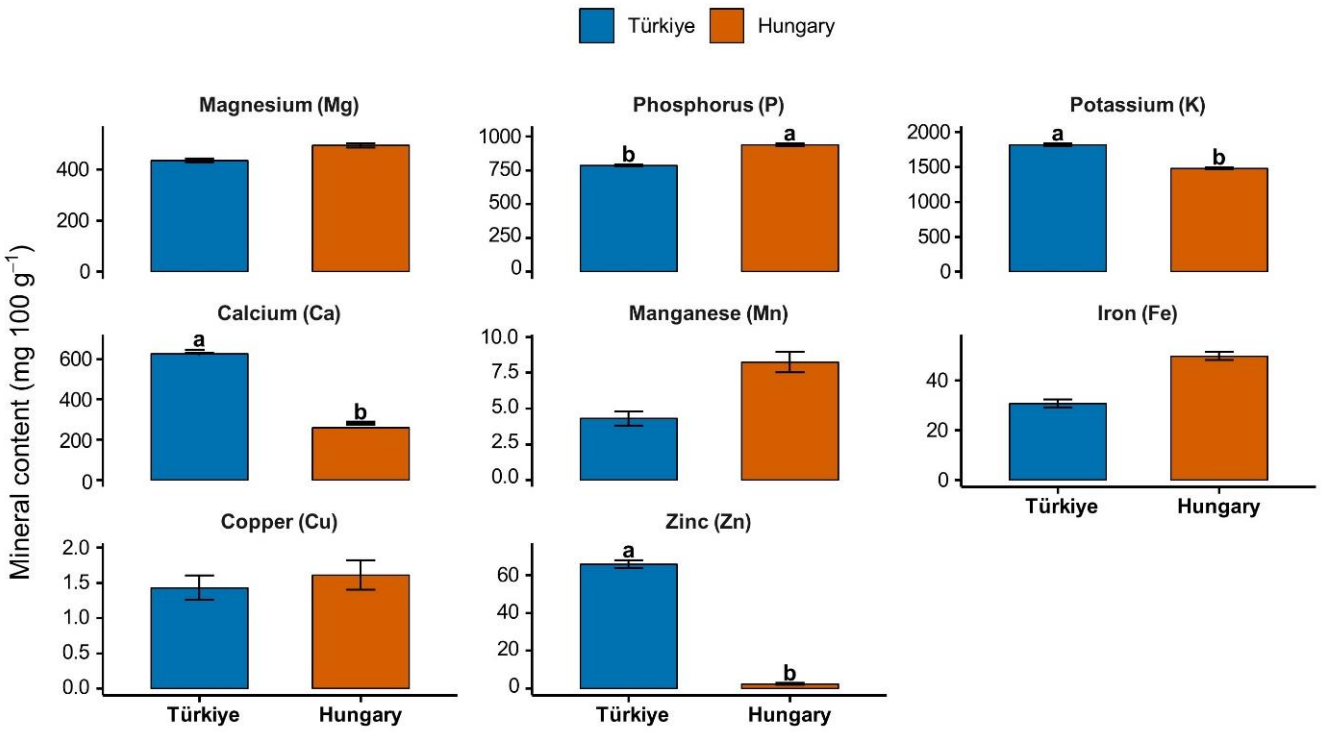


Figure 3. Comparison of mineral contents of coriander seeds grown in Türkiye and Hungary. Different letters indicate significant differences at $p < 0.05$.

3.3. Impact of Location on Fatty Acid Profile

Petroselinic acid (18:1n12), the primary component determining the commercial and industrial value of coriander oil, maintained its status as the dominant fatty acid at both cultivation sites. However, its synthesis occurred at a significantly higher level in the Türkiye location (72.24%) compared to the Hungary location (64.80%), with the difference being statistically significant.

In contrast, an inverse distribution was observed for linoleic acid (18:2n6), the key polyunsaturated fatty acid (PUFA). Seeds cultivated in Hungary contained a markedly higher proportion of linoleic acid (21.27%), whereas those grown in Türkiye exhibited a lower concentration (15.18%). Due to the predominance of petroselinic acid, the total monounsaturated fatty acid (MUFA) content was also significantly higher in the Türkiye location (79.82%) compared to those from Hungary location (71.50%).

Although seeds from the Hungary location showed higher levels of saturated fatty acids such as palmitic (16:0), stearic (18:0), and arachidic acid (20:0) these differences were not statistically significant ($p > .05$). The total unsaturated fatty acid (UFA) content remained high in both locations (95.05% in Türkiye and 92.85% in Hungary), with no statistically significant location-based effect observed for this parameter ($p > .05$). Similarly, the linoleic to oleic acid ratio did not differ significantly between the two sites (2.05 in Türkiye and 3.26 in Hungary). While the coriander preserved its core fatty acid profile across both regions, the proportions of critical components such as petroselinic and linoleic acid were directly influenced by local microclimatic conditions and soil characteristics.

Table 1. Fatty acid composition (%) of coriander seeds grown in different ecological conditions.

Fatty acids	Türkiye	Hungary	*p*
Myristic acid (14 : 0)	0.04 ± 0.00	0.06 ± 0.00	ns
Palmitic acid (16 : 0)	3.40 ± 0.16	4.81 ± 0.12	ns
Palmitoleic acid (16 : 1)	0.15 ± 0.01	0.16 ± 0.01	ns
Heptadecanoic acid (17 : 0)	0.05 ± 0.01	0.06 ± 0.01	ns
Stearic acid (18 : 0)	0.61 ± 0.03	1.10 ± 0.05	ns
Petroselinic acid (18:1n12)	72.24 ± 0.52 a	64.80 ± 0.25 b	<.05
Oleic acid (18 : 1n9)	7.43 ± 0.15	6.54 ± 0.18	ns
Linoleic acid (18 : 2n6)	15.18 ± 0.18 b	21.27 ± 0.57 a	<.05
Linolenic acid (18 : 3n3)	0.35 ± 0.03	0.21 ± 0.02	ns
Arachidic acid (20 : 0)	0.04 ± 0.01	0.08 ± 0.01	ns
Behenic acid (22 : 0)	0.24 ± 0.02	0.49 ± 0.08	ns
Total	99.74 ± 0.30	99.58 ± 0.31	ns
SFA	4.39 ± 0.17	6.59 ± 0.07	ns
MUFA	79.82 ± 0.39 a	71.50 ± 0.33 b	<.05
PUFA	15.23 ± 0.22	21.35 ± 0.57	ns
Total UFA	95.05 ± 0.47	92.85 ± 0.38	ns
linoleic/oleic	2.05 ± 0.07	3.26 ± 0.17	ns

SFA (Saturated Fatty Acids), MUFA (Monounsaturated Fatty Acids), PUFA (Polyunsaturated Fatty Acids), and UFA (Total Unsaturated Fatty Acids) refer to the respective classes of fatty acids identified in the seed oil samples. Values are expressed as mean ± standard deviation. Statistical differences were determined using independent sample t-tests ($p<.05$). ns: Not Significant.

4. Discussion

The results indicate that the quality attributes of coriander (*Coriandrum sativum* L.) varied significantly depending on the growing location. The two experimental sites exhibited pronounced microclimatic and edaphic contrasts during the vegetation period, which were clearly reflected in seed composition. In Budapest, precipitation reached 228.4 mm in May and 109.8 mm in July, whereas rainfall in Erzurum declined to only 3 mm during the critical month of July, creating a marked divergence in water availability. Temperature regimes also differed considerably: in Budapest, mean temperatures increased from 12.7 °C in April to a seasonal maximum of 22.7 °C in June, while in Erzurum the growing season began later at 11.9 °C in May and rose gradually to 20.3 °C by August. Under these relatively cooler and high-altitude conditions (approximately 1787 m), crude oil content was higher in Erzurum (25.82%) than in Budapest (20.64%). Similarly, fatty acid composition displayed a location-dependent pattern, with higher proportions of petroselinic acid in Erzurum (72.24%) and elevated linoleic acid levels in Budapest (21.27%), suggesting that environmental conditions modulated lipid biosynthesis. In addition, mineral composition differed between locations in parallel with soil characteristics, indicating that both climatic factors and soil chemical properties jointly influenced nutrient accumulation and metabolic processes during seed development (Budak et al., 2026; Pant et al., 2021).

Mineral accumulation also followed a pattern consistent with soil conditions. The high level of available phosphorus in Budapest soils (291 mg kg^{-1}) corresponded with greater phosphorus concentration in seeds from this location (938.73 mg 100 g^{-1}), while lower soil phosphorus in Erzurum (4.41 kg P_2O_5 da^{-1}) was associated with reduced seed phosphorus content (785.86 mg 100 g^{-1}). Conversely, the elevated potassium content of Erzurum soils (171 kg K_2O da^{-1}) was reflected in higher potassium concentration in Erzurum seeds (1816.45 mg 100 g^{-1}) compared to those from Budapest (1478.15 mg 100 g^{-1}). Differences in soil reaction and $CaCO_3$ levels may have further influenced nutrient availability, particularly phosphorus, thereby reinforcing location-specific effects. Taken together, these findings further support the direct linkage between soil nutrient availability, climatic variability, and element-specific accumulation patterns observed in coriander seeds (Sehgal et al., 2018).

Coriander seed crude protein content is highly variable depending on genotype, cultivation environment, and processing/fractionation, and dry-matter–based values are commonly reported in the range of approximately 11.0% to 22.2% (Coşkuner & Karababa, 2007; Hojilla-Evangelista & Evangelista, 2017; Nadeem et al., 2013; Shahwar et al., 2012). Studies on the fixed oil content of coriander (*Coriandrum sativum* L.) seeds indicate that this trait varies widely in response to genetic background, cultivation conditions, ecological factors, and agronomic practices, with reported dry

matter based oil contents ranging from approximately 9.9% to 28.4% (Asgarpanah & Kazemivash 2012; Nadeem et al., 2013; Ramadan & Mörsel 2002). Geographic origin and growing environment have also been shown to significantly influence oil yield in coriander: Sriti et al. (2011) reported an oil yield of 21.87% in Tunisian material, declining to 15.84% in Canadian samples. Similarly, Uitterhaegen et al. (2016) quantified 22.9% fixed oil in French-origin seeds and emphasized the sensitivity of oil yield to the production environment. Basol et al. (2024) further documented an oil range of 10.22-34.03% and reported an oil content of 33.93% for the Gürbüz cultivar, which was also used as plant material in the present study. In line with previous reports, our results showed that coriander seeds produced at the Türkiye location had the highest oil content (25.82%), whereas the value decreased to 20.64% at the Hungary location.

With respect to fixed-oil composition, numerous studies have established that petroselinic acid is the dominant fatty acid in coriander (*Coriandrum sativum* L.) seed oil. Ramadan & Mörsel (2002) reported a petroselinic acid proportion of 65.7%, whereas Sriti et al. (2010) and Sriti et al. (2011) documented higher levels of 76.6% and 74-77%, respectively. Working with registered cultivars in Türkiye, Kiralan et al. (2009) likewise noted that petroselinic acid can reach approximately 80% of total fatty acids. Evidence from broader genetic surveys further indicates that the magnitude of variation can expand substantially; Basol et al. (2024), for example, reported petroselinic acid contents ranging from 24.47% to 87.70% across 119 coriander genotypes, underscoring the strong genotype dependency of this trait. In this context, the petroselinic acid levels determined in the present study 72.24% in the Türkiye location and 64.80% in the Hungary location are consistent with the characteristic fatty acid profile of coriander while also pointing to a clear location-driven differentiation. The higher petroselinic acid proportion observed under Türkiye conditions may be attributed to environmentally induced shifts in lipid metabolism, as drought and heat stress are known to alter desaturation pathways and to favor relatively higher proportions of monounsaturated fatty acids over polyunsaturated fractions. Conversely, the lower petroselinic acid level recorded in Hungary, where conditions may be more humid and thermally moderate, can be explained by environmental effects on fatty acid biosynthesis and, in particular, on the enzymatic regulation of desaturation steps (Hajib et al., 2023; Nguyen et al., 2020).

Although petroselinic acid is the principal constituent of coriander oil, under favorable growth conditions the plant can maintain a more dynamic fatty-acid metabolism, allowing the conversion of monounsaturated fatty acids into polyunsaturated fatty acids to proceed (Msaada et al., 2009). In this context, the FAD2 enzyme catalyzes the desaturation of monounsaturated fatty acids such as petroselinic and oleic acids to form linoleic acid, and this enzymatic flux may operate more efficiently in environments without water limitation, where photosynthetic activity and carbon-nitrogen balance remain relatively stable (Cerone & Smith, 2022; Gishini et al., 2025). Accordingly, under humid and thermally moderate conditions, enhanced desaturation activity could increase the conversion of petroselinic acid to linoleic acid, resulting in a lower measured proportion of petroselinic acid (Nguyen et al., 2020). In addition, when plants experience drought or elevated temperatures, they may preferentially accumulate monounsaturated fatty acids to preserve the oxidative stability of stored lipids and mitigate oxidative stress risk; conversely, under mild and humid conditions, the relaxation of this protective selective pressure may favor relatively greater allocation toward polyunsaturated fatty acids such as linoleic and linolenic acids (Coban et al., 2024; He & Ding, 2020; Upchurch, 2008). Overall, these findings indicate that, beyond total fixed-oil content, petroselinic acid is a location-sensitive quality trait in coriander and that site selection can meaningfully shape oil quality.

The mineral composition of coriander (*Coriandrum sativum* L.) seeds shows pronounced variability as a function of the production environment particularly soil properties and climatic conditions as well as the genetic material and crop management practices applied (Asif et al., 2014; Ayran et al., 2017; Beyzi et al., 2017; Özcan, 2004). In this context, Özcan (2004) reported that coriander seed samples collected from Konya (Türkiye) contained potassium (K) as the predominant macronutrient at approximately 1236.7 mg/100 g, followed by calcium (Ca), magnesium (Mg), and phosphorus (P) (Özcan, 2004). Similarly, working in Egypt, El Hadidy and Rizk (2018) quantified seed potassium at 1026 mg/100 g, calcium at 608.13 mg/100 g, and iron (Fe) at 16.72 mg/100 g, further illustrating how mineral profiles can differ across production. In multiple coriander genotypes cultivated in Türkiye, phosphorus and iron were highlighted as particularly variable, with P ranging from 297.0 to 788.0 mg/100 g and Fe from 4.2 to 43.5 mg/100 g (Ayran et al., 2017). Studies evaluating material from different origins likewise indicate that both macronutrients (K, Ca, Mg, P) and several micronutrients (Fe, Zn, Cu, Mn) can exhibit substantial variation, whereas zinc (Zn) and copper (Cu) are often reported within comparatively narrower ranges (Asif et al., 2014). Moreover, cultivar-level assessments suggest that mineral accumulation is genotype-responsive, with certain cultivars showing greater enrichment of elements such as Ca and Mg (Beyzi et al., 2017). Taken together, these findings underscore that mineral composition in coriander seeds should be interpreted not as a fixed value, but within the context of interactions between the growing environment and the genetic background.

5. Conclusion

This study demonstrates that cultivating the Gürbüz coriander cultivar (*Coriandrum sativum* L.) under two

contrasting ecological conditions markedly influences seed quality traits. The cultivation site was particularly decisive for crude oil concentration and fatty acid composition: seeds produced under Türkiye locations exhibited higher oil content, whereas protein concentration did not differ significantly between locations. The effect of location on mineral composition was more selective; seeds grown in Türkiye accumulated higher levels of K, Ca, and Zn, while P accumulation was greater under Hungary conditions. Petroselinic acid, the principal determinant of coriander oil quality, remained the dominant fatty acid at both locations but was significantly higher at the Türkiye location; conversely, linoleic acid was higher at the Hungary location. Although total unsaturated fatty acids were maintained at high levels in both locations, the distribution between mono and polyunsaturated fractions shifted with site, supporting the shaping role of climatic and edaphic factors on lipid metabolism and elemental uptake. Collectively, these findings indicate that selecting an appropriate production environment according to the intended end use is critical for optimizing coriander seed quality. Future research should strengthen the generalizability of location effects through multi-year trials across a broader range of environments and genotypes, and should evaluate management practices alongside quality parameters to better elucidate climate-soil interactions.

Compliance with Ethical Standards

This study does not require ethical committee approval.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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