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ECONOMIC IMPORTANCE OF MEDICINAL AND AROMATIC PLANTS IN TURKEY: THE EXAMPLES OF THYME AND LAVENDER

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ABSTRACT

Medicinal and aromatic plants have many uses -as food, medicines, cosmetics and spices- and have been used for such purposes since the beginning of human history. Turkey's unique geographic location, climate and plant diversity offer significant potential to the medicinal and aromatic plant market. This study presents an analysis of the economic importance of medicinal and aromatic plants through two exemplary plants: thyme and lavender. Specifically, the importance of these two plants is analyzed by way of an examination of the strengths, weaknesses, opportunities and threats (SWOT).

Keywords: Agricultural economics, Turkey, medicinal and aromatic plants, thyme, lavender

TIBBİ VE AROMATİK BİTKİLERİN TÜRKİYE'DE EKONOMİK ÖNEMİ: KEKİK VE LAVANTA ÖRNEKLERİ

ÖZ

Tıbbi ve aromatik bitkiler, gıda, ilaç, kozmetik ve baharatlar gibi birçok kullanıma sahiptir ve insanlık tarihinin başlangıcından beri bu amaçlar için kullanılmaktadır. Türkiye'nin eşsiz coğrafi konumu, iklimi ve bitki çeşitliliği, tıbbi ve aromatik bitki pazarı için önemli bir potansiyel sunmaktadır. Bu çalışma, tıbbi ve aromatik bitkilerin ekonomik öneminin iki örnek bitki yoluyla değerlendirilmesini amaçlamaktadır: kekik ve lavanta. Bu iki bitkinin önemi, güçlü yanların, zayıflıkların, fırsatların ve tehditlerin (SWOT) incelenmesi yoluyla analiz edilmektedir.

Anahtar Kelimeler: Tarım ekonomisi, Türkiye, tıbbi ve aromatik bitkiler, kekik, lavanta

INTRODUCTION

Medicinal and aromatic plants have many uses -as food, medicine, cosmetics and spices- and have been used for such purposes since the beginning of human history. Figure 1 briefly shows the uses of medicinal and aromatic plants. The World Health Organization [3] reports that medicinal plants still feature in the traditional health systems in developing countries. While some plants are cultivated and produced, a significant proportion of those used as medical treatments are foraged from nature. The most prominent and researched medicinal and aromatic plants are those used for therapeutic purposes. After the 1990s in particular, new uses of medicinal and aromatic plants emerged, and since then, demand for natural products has increased. Tripathi et al. [43] reports that the total trade in medicinal and aromatic plants have increased from US$ 2.4bn (billion) in 1996 to US$ 6.2bn in 2013 with annual growth rate of 5.4%. In terms of trade value, more than half of the total export of medicinal and aromatic plants (54.2%) is attributed to five countries namely China (27.1%), Hong Kong (7.6%), USA (7%), India (6.5%), and Germany (6.1%) in past 18 years [43]. The United States, the European Union and Japan are the leading consumers of natural products [25]. In another study, Vasisht, Sharma and Karan [46] state that an annual average growth rate of 2.4% in volume and of 9.2% in export value was observed in the international trade of medicinal plants between 2001 and 2014. Their study further identified China and India in Asia, Egypt and Morocco in Africa, Poland, Bulgaria and Albania in

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Europe, and Chile and Peru South American as the leading producers.

Turkey's unique geographic location, climate and plant diversity offer significant potential to the medicinal and aromatic plant market. Turkey produces many herbal products that are used as inputs in the herbal medicine, plant chemical, food and food additive, cosmetics and perfumery sectors in developed countries [28].

In Turkey, medicinal and aromatic plants are produced mainly in the Aegean, Marmara, Mediterranean, Eastern Black Sea and South-Eastern Anatolia regions. These products must be gathered in the desired quantity and must be of sufficient quality to adequately utilize the market potential of medicinal and aromatic plants. Developing cultivated species for the creation of quality products that respond to consumer and industry demands, determining appropriate ecological conditions, the timely harvesting of natural plants without harming nature, determining post-harvest processes and technologies will all increase the production and market opportunities in medicinal and aromatic plants [17].

This study presents an analysis of the economic importance of medicinal and aromatic herbs through two exemplary plants: thyme and lavender. Specifically, the importance of these two plants is analyzed through an examination of their strengths, weaknesses, opportunities and threats (SWOT). A SWOT analysis is fundamentally a technique for revealing key variables that have impact on a firm's/sector's performance [31, 32]. This technique is very useful while investigating constraints and possibilities of any sector through a systematic approach of self-examination into both positive and negative concerns [2]. Akca et al. [2] utilize SWOT method to analyze fishery sector in Turkey, and Knierim and Nowicki [33] demonstrate and discuss the tool's recent use in agriculture and rural development. The rest of this paper is organized as follows. Sections 2 and 3 present the current situation in the trade of, respectively, thyme and lavender in Turkey and around the world, and examine the importance of the two plants through a SWOT analysis. The final section concludes the study.

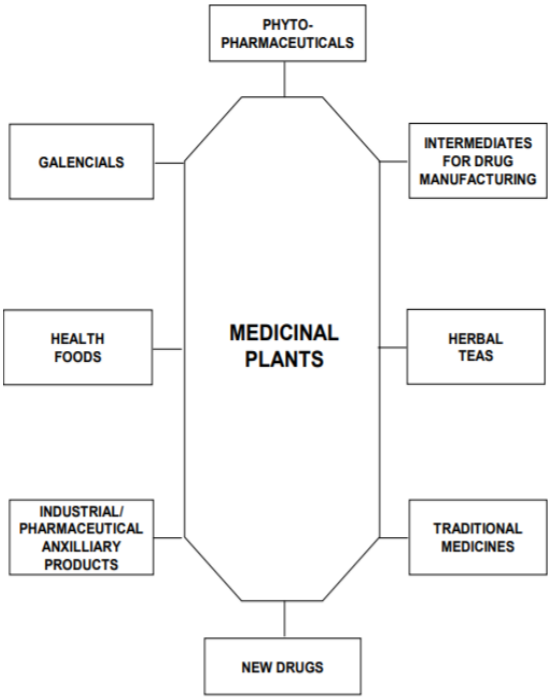

Figure 1. Uses of medicinal and aromatic plants [24]

Thyme

Although they belong to the same family of flowering plants, plant species derived from different species of herbaceous plants are referred to as "thyme" in Turkey. The thyme genera used commercially in Turkey, all of which belong to the *Lamiaceae* family, are *Origanum*, *Thymbra*, *Coridothymus*, *Satureja* and *Thymus* [4]. The most exported species, which are used in the production of essential oils, are *Origanum onites* (Izmir thyme; ball thyme), *Origanum vulgare* subsp. *hirtum* (Istanbul thyme; black thyme), *Origanum minutiflorum* (Sutculer thyme; highland thyme, buckle thyme), *Origanum dubium* (Alanya thyme; white thyme) and *Origanum syriacum*. *bevanii* (Syrian thyme, Israeli thyme). Other traded species include *Coridothymus capitatus* (Spanish thyme), *Thymbra spicata* and *Thymbra sintenisii* (pointed thyme), *Satureja cuneifolia*, *Satureja hortensis*, *Satureja montana*, *Satureja spicigera* (Trabzon thyme) and *Thymus eigii* [4]. The common feature of all these species is their high essential oil content, the main compound of which is carvacrol and/or thymol, and these are the substances that give thyme its peculiar smell [14].

Production and Trade of Thyme around the World

Thyme has been known since the Middle Ages, especially in the Mediterranean region and Mexico, where it is consumed as a spice. The rest of the world, however, was generally not introduced to thyme until after World War II [44]. With the addition of thyme to international cuisines, it started to be consumed extensively in meat dishes and pizzas, and its use in salads, soups and sauces has increased significantly. As a result of these developments, there has been a significant increase in global demand for thyme.

The major producers of thyme today are Turkey, Greece, Italy, Spain and the United States [44]. Tunca and Yeşilyurt [44] claim that global thyme production increased by approximately 105 percent between 1985 and 2011. Turkey carries out approximately two-thirds of global thyme production [14], which in 2011 amounted to 12.000 tons, with the main contributors to this figure being Turkey (8.182 tons), Peru (3.324 tons) and Mexico (215 tons) [19]. According to 2016 estimates the global trade volume of thyme is between 12.000 and 13.000 tons. Turkey's exports were between 9.000 and 12.000 tons between 2011 and 2016, of which an estimated 80 percent was cultivated and the rest foraged [19].

Production and Trade of Thyme in Turkey

Some 157.000 da is set aside for the cultivation of thyme in Turkey, with annual production amounting to 18.000 tons in 2019 [45]. Figure 2 details thyme production in Turkey for the 2004-2019 period, in which it can be seen that production tripled in just 15 years in the country. As thyme is grown in dry agricultural areas in Turkey, the yield is around 125 kg/da on average. Denizli is the biggest producer city, followed by Manisa, İzmir, Isparta, Burdur, Aydın and Çanakkale. In 2019, 15.000 tons of thyme were exported, generating $60 million in revenues [5].

Turkey exports approximately 60 percent of the thyme consumed around the world. More than 90 percent of the exported thyme is from the *Origanum* species, among which Izmir thyme takes the largest share. The export of thyme oil has also gained momentum in recent years. In 2019, $3 million was earned in revenues from the 30 tons of thyme oil exports. Thyme consumption in Turkey amounts to around 1.500 tons per year, while the United States is the leading export destination, followed by Germany and other European countries [45].

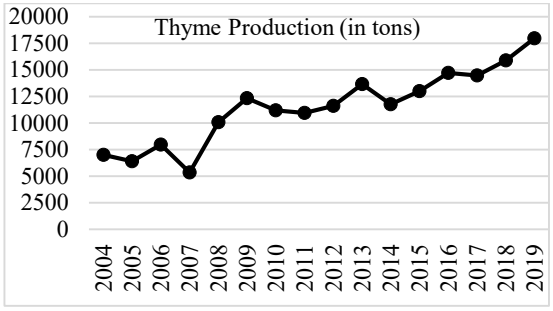

Figure 2. Thyme production in Turkey [45]

Importance of Thyme for Turkey

Thyme is tolerant of cold and drought and is not very selective in terms of soil and ecological requirements, and high yields can be generated from small-scale production. This part of the study evaluates the importance of thyme for Turkey through a SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats), the results of which are given in the tables below. Table 1 presents the strengths and weaknesses and Table 2 presents the opportunities and threats of thyme for Turkey.

Table 1. Strengths and weakness of thyme for Turkey

Strengths
Increasing demand for thyme in the world and Turkey [11].
The use of thyme in various industries in the world [11].
The thyme species produced are perennial [23].
Increasing market for thyme products, thyme oil and thyme juice [40].
Thyme species are ecologically suitable for Turkey [11].
Genetic variations in terms of thyme species [35].
Superior quality of thyme (especially *Origanum species*) produced in Turkey [35].
Weaknesses
Mostly considered as a spice [4].
The use of thyme by-products is not fully developed.
Lack of producer associations [39].
Losses of quality during production and processing [39].
No support based on contract production.
Lack of mechanization in harvesting and post-processing [16].
Insufficient technical staff and producer know-how [11].

Table 2. Opportunities and threats of thyme for Turkey

Opportunities
Thyme can be collected from nature as well as field produced [39].
Suitability for storage [35].
Addressing different branches of industry [20].
A profitable and important alternative product in rural areas [38].
Low disease and pest threat, low use of medicines and fertilizers.
Decrease in production cost due to its perennial nature.
Can be collected as non-wood forest products in forest areas [35].
Threats
Lack of regional product basins.
Insufficient control over foraging from nature.
Incorrect disinfection and risk of residues [34].
Different herbal materials used for adulteration in the thyme.
No continuous breeding studies on species development.

Lavender

It is estimated that there are approximately 750.000-1.000.000 plant species in the world, approximately 500.000 of which have been identified, and 20.000 of which are utilized. An estimated 3.000 of these plants are cultivated [18]. Since ancient times, people have looked to nature for healing products, with a Sumerian clay slab from Nagpur thought to be the oldest evidence of the use of plants for medicinal purposes [36].

The use of lavender dates back 2.500 years, having been used by the Egyptians, Phoenicians and Arabs for both mummification and perfumery. The plant's name is derived from the Latin word "Lavo", which means "to bathe" [6]. Lavender is a valuable essential oil plant of the *Lamiaceae* family [15]. It is a perennial, evergreen and important plant that is produced for its flowers. It grows to heights of 20-60 cm under the conditions in Turkey, blooms in June and July, and fertilizes itself [22]. It is mostly cultivated in France, Bulgaria, the United Kingdom, the United States and North Africa, with some production in Turkey. Only *Lavandula stoechas* grows in Turkey under natural conditions, and this variety has low aromatic properties, being used rather as a medicinal plant [15].

Production and Trade of Lavender around the World

People have been taking advantages of the fragrances of plants for some 4000 years. With the discovery of the fire, people began making use of the scents and resins produced by burning trees for religious rituals. Traces of scented oils and perfume containers have been discovered in the tombs of kings dating back to 5000 BC [47]. Beginning in 3000 BC, the ancient Egyptians started making use of rich fragrances in their personal care and massaged themselves with fragrant oils to protect their bodies from the sun. Perfume and fragrance production, which had its Golden Age in the ancient Egyptian period, arrived in Europe in the 14th century [42], where it developed rapidly. Its industrialization began in the Grasse Region of France in the 16th century, and the agricultural production of aromatic plants started to become widespread [7]. The total sales volume of cosmetics and personal care products has recently been experiencing sustainable growth around the world. The global revenues from the sector, which amounted to $420 billion in 2018, are forecast to exceed $716 billion by 2025 [8].

The part of the lavender plant with economic value is its flowers, from which the essential oils are obtained. These oils, which are among the 15 most frequently used in the world, are used mostly in the cosmetics and perfume sectors, while its fragrance makes its use popular in soap and other such products, in the pharmaceutical sector, and as an aromatherapy product due to its pain-relieving, calming and insomnia-relieving properties [12]. In 2017, essential oils with a value of $5.44 billion are exported around the world [9]. The top exporters in essential oil market are the United States ($697M), India ($665M), China ($522M), France ($466M) and Brazil ($409M) and the top importers are the United States ($1.27B), France ($444M), Germany ($353M), the United Kingdom ($341M) and India ($258M) [9]. Table 3 presents the top 15 essential oils in terms of global trade.

France is the largest producer of lavender in the world, with around 200.000 da set aside for production. *Lavandula* × *intermedia* -type lavenders account for around 160.000 da of this area, with the remaining 40.000 da taken up by *Lavandula angustifolia*- type lavenders [29].

Production from the lavender fields of Provence in France generates a turnover of €30 million, and provides direct employment to 10.000 people, and indirect employment to another 20.000. Furthermore, it ensures the maintenance of nearly 2.000 farms, including some in areas with low agricultural potential, such as in the mountains and on dry plateaus. Tourism in these regions, with the help of lavender's attraction, generates a further $1.7 billion per year [29]. In Bulgaria -the second largest lavender producer in the world- *L. angustifolia* is cultivated on an area of approximately 65.000 da. Combined, France and Bulgaria carry out two-thirds of the total global production [30].

Table 3. Traded quantities and values of essential oils, top 15 [27]

Rank	Essential Oil	Species	Family	Volume (t)	Value (US$000)
1	Orange	*Citrus sinensis*	*Rutaceae*	26.000	58.500
2	Commint	*Mentha arvensis*	*Lamiaceae*	4.300	34.400
3	Eucalyptus cineole-type	*Eucalyptus globulus, E. polybractea*	*Myrtaceae*	3.728	29.800
4	Citronella	*Cymbopogon species*	*Poaceae*	2.830	10.800
5	Peppermint	*Mentha × piperita*	*Lamiaceae*	2.367	28.400
6	Lemon	*Citrus limon*	*Rutaceae*	2.158	21.600
7	Eucalyptus citronellal-type	*Eucalyptus citriodora*	*Myrtaceae*	2.092	7.300
8	Clove leaf	*Syzygium aromaticum*	*Myrtaceae*	1.915	7.700
9	Cedarwood (US)	*Juniperus virginiana*	*Cupressaceae*	1.640	9.800
10	Litsea cubeba	*Litsea cubeba*	*Lauraceae*	1.005	17.100
11	Sassafras (Brazil)	*Ocotea pretiosa*	*Lauraceae*	1.000	4.000
12	Lime distilled (Brazil)	*Citrus aurantifolia*	*Rutaceae*	973	7.300
13	Native spearmint	*Mentha spicata*	*Lamiaceae*	851	17.000
14	Cedarwood (Chinese)	*Chamaecyparis funebris*	*Cupressaceae*	800	3.200
15	Lavandin	*Lavandula intermedia*	*Lamiaceae*	768	6.100

Production and Trade of Lavender in Turkey

Lavender production in Turkey started in the 1960s, with a small quantity of *Lavandula × intermedia* slips brought by factory owners and distributed to local farmers in the Keçiborlu District of the Isparta Province [41]. The increased demand witnessed in the 1990s led to an increase in production, covering a total area of around 3.500 da in the surrounding villages, but particularly in the village of Kuyucak. In the 2010s, lavender production began to spread to other parts of Turkey with the increase in global demand. The plant, which is well-suited to the climate and soil structure of Turkey, accelerated its spread when it was noticed by the tourism sector.

Lavender yields in Turkey total 150-400 kg/da (flower), of which between 2% and 5% is oil. As of 2019, farmers in Turkey have been selling 1 kg of lavender for 1.5-2 TL, and 1 kg of dried lavender for 10-15 TL. From 1 da of lavender area, farmers can obtain revenues of 800-1.100 TL [10]. According to data provided by TUIK, the area set aside for lavender production in Turkey was 8.700 da in 2018, but this figure rose to exceed 10.000 da in 2019. Approximately 1.500 tons of lavender flowers can be obtained from these areas, from which 20-30 tons of lavender oil can be produced. The three leading cities in lavender production in Turkey are Isparta, Afyonkarahisar and Burdur.

Table 4. Strengths and weakness of lavender for Turkey

Strengths
Ideal for utilizing marginal agricultural areas [38].
High income can be obtained per unit area in small and inefficient lands.
Since it has little susceptibility to disease and pests, it is highly suitable for organic farming, which is preferred mostly by the foreign market [17].
It is suitable for dry farming [12].
Low input costs [21].
It is suitable for landscape gardening [37].
Weaknesses
Cultivation is not fully known to farmers.
Low trained technical staff [21].
Absence of a registered lavender species in Turkey.
Absence of lavender production cooperatives [13].

Importance of Lavender for Turkey

Lavender is an evergreen plant, is very tolerant to cold and drought, and is highly fertile per unit area on small-scale lands. In this part of the study we evaluate the importance of lavender for Turkey through a SWOT Analysis

(Strengths, Weaknesses, Opportunities, Threats), the results of which are given in the tables below. Table 4 presents the strengths and weaknesses and Table 5 presents the opportunities and threats related to lavender in Turkey.

Table 5. Opportunities and threats of lavender for Turkey

Opportunities
The lavender oil deficit in the world can be fulfilled by Turkey [21].
Lavender farming is uncomplicated [12].
Threats
Starting production without adaptation studies of lavender species.
The arrival in Turkey of different diseases and pests, especially Stolbur phytoplasma [26].
Due to the absence or enforcement of a control mechanism, the spread of species that are not commercially suitable is possible.
Parallel to production, insufficient development of industry.

CONCLUSION

Demand for medicinal and aromatic plants have been increasing gradually. Since Turkey is located at the intersection of three important floristic regions, it has a significant market potential in the production of these plants due to its wide variety of plants, different climates and large surface area [17]. Raising the awareness of producers and forming cooperative structures will show their impact on production, processing and marketing of medicinal and aromatic plants in Turkey [13]. Medicinal and aromatic plants offer an alternative source of income to the people those live in their own regions and will reduce the migration to cities from rural areas [38]. So, Turkey should hold an upper hand in the world medical and aromatic plant market [11].

In order to produce products such as thyme which has an important place in Turkey's foreign trade, production and marketing methods in accordance with the standards are needed. With these standards, it will be possible to produce products with higher quality and therefore economic value, and the producers will be able to earn more profit [1]. Besides as a spice, its use in various industries is increasing the need for thyme every day. Turkey is the world's leading producer and the highest volume exporter of thyme but will need to increase thyme production if it is to maintain its current status in the world herb and spice market. Furthermore, there are needs to expand the scope of the control and high-quality production practices at all stages of the process, from field to packaging.

Lavender is one of the 15 most traded essential oil plants in the world. Almost half of the global lavender production is in France. The sectors that make use of lavender oil are searching for new products from new countries due to the shortages in supply arising from the decreasing product output levels in France. The Stolbur phytoplasma pest, which first emerged in the 1970s, has caused a decline in production, however it is highly possible that this shortfall in supply can be met by Turkey, considering the climate, soil conditions and tendency of Turkish farmers to produce lavender. In order to preserve diversity and sustainability in products collected from nature, it will be useful to provide information about the characteristics and collection times of the products to forest villagers who collect these products, and if applicable, to enforce legal requirements [1]. Turkey's production level of lavender is relatively low and has a significant opportunity of increasing the production of this plant that has a high foreign trade value.

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