

Evaluation of Yield and Quality Characteristics of Dill (*Anethum graveolans* L.) in Turkey and the World

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ABSTRACT: *In recent years, the volume of use of Medicinal and Aromatic Plants (MAPs) increases with the formation of new usage areas and increasing the demand for natural products day by day. One of these plants is dill (*Anethum graveolans* L.), which is usually an annual herb in Umbelliferae (Apiaceae) family. Its origin is Asia and it is seen commonly in our country due to grow naturally in the mediterranean basin. India and Pakistani are the most producer countries of this plant. Moreover, USA, UK, Mexico, Germany, Hungary and Netherlands produce high amounts of dill. In addition to growing naturally, it also is grown in gardens in our country frequently. In Turkey dill had cultivated in 7387 da areas and it was produced 7208 tons in 2017. 111 tons of dill was produced in 84 da areas under protective cover (low tunnel, plastic greenhouse and high tunnel) greenhouse conditions in 2017. Dill was most growth in Mediterranean region with 4113 da cultivation areas and 4061 tones production and followed Marmara, Aegean and Internal Anatolia in 2017 year in Turkey. In the present review, the chemistry, yield and quality characteristics, and economic value of dill and its components were discussed.*

Keywords: *Anethum graveolans* L., dill, cultivation area, economic value, quality characteristics, yield and componenet.

Dünya’da ve Türkiye’de Dereotu (*Anethum graveolans* L.) Bitkisinin Verim ve Kalite Özelliklerinin Değerlendirilmesi

ÖZ: *Son yıllarda, tıbbi ve aromatik bitkilerin yeni kullanım alanlarının oluşması ve doğal ürünlere olan talebin artmasına bağlı olarak, bu bitkilerin kullanım hacmi her geçen gün artmaktadır. Bu bitkilerden birisi de Apiaceae (Umbelliferae) familyasından genellikle tek yıllık bir bitki olan dereotu (*Anethum graveolans* L.)’dur. Anavatanı Asya olup, Akdeniz havzasında da doğal olarak yetiştiğinden, ülkemizde yaygın bir şekilde görülmektedir. En önemli üreticileri Hindistan ve Pakistan’dır. Aynı zamanda, ABD, İngiltere, Macaristan, Almanya, Meksika ve Hollanda gibi ülkelerde de yüksek miktarlarda üretilmektedir. Ülkemizde doğal olarak yetişmesinin yanı sıra, bahçelerde de sıklıkla yetiştirilen bir bitki türüdür. Türkiye’de 2017 yılında dereotu 7387 da alanda yetiştirilmiş ve 7208 ton üretilmiştir. 2017 yılında 84 da alan örtü altı yetiştiriciliğinde (alçak tünel, plastic sera ve yüksek tünel) 111 ton üretilmiştir. Türkiye’de en fazla 4113 da alan ve 4061 ton üretimi ile Akdeniz bölgesinde, yetiştirilirken, bu bölgeyi Marmara, Ege ve İç Anadolu bölgeleri takip etmiştir. Bu derleme de, dereotu bitkisinin kimyasal yapısı, verim ve kalite kriterleri, ekonomik değeri ve bileşenleri tartışılmıştır.*

Anahtar Kelimeler: *Anethum graveolans* L., dereotu, ekim alanı, ekonomik değer, kalite kriterleri, verim ve bileşenleri.

INTRODUCTION

Apiaceae (Umbelliferae) is one of the largest plant family and it is called "maydanozgiller" in Turkish and "carrot family" in English. Apiaceae family contains annual and perennial plants which are generally herbaceous and sometimes growing in bush form (Pulur, 2012). It is also rich in terms of essential oil. This family has a widespread in the northern hemisphere and also rare spread in the tropical regions. Turkey is one of the countries included these plants. Apiaceae consists of approximately 300 genera and more than 3000 species (Stace, 1999). One of these species is dill (*Anethum graveolans*) which is called "dill" in English and called "dereotu" in Turkey, but it is named "tereotu, turakotu, durakotu, tarhanaotu, darakotu" different local names of Turkey (Baytop, 1994). Dill is an annual herb from Apiaceae family and it's native to south west Asia or south east Europe and it has been noted that it has cultivated through the history (Bailer et al., 2001) and it has grown in Mediterranean region. Today, dill is cultivated almost all of Europe, United States (US) and many other countries, including the Mediterranean countries. Dill is grown in moist areas and also has not soil selectivity (Ceylan, 1997). Therefore, cultivation of dill is widespread in different places of Turkey. Some researchers reported that its medicinal uses are as a vegetable, a carminative, an aromatic, an antispasmodic, diuretic, stimulant and stomachic (Simon et al., 1984; Hornok, 1992; Sharma, 2004). Dill contains a large variety of antioxidant photochemical, bioactive molecules or antimicrobial activity against *Saccharomyces cerevisia* and *Listeria monocytogenes* (Pascal et al., 2002) and it can neutralize the free radicals thanks to retarding the progression of many chronic diseases associated with oxidative stress and reactive oxygen species (Sun et al., 2002; Liu, 2003). Dill has been used against digestive system disorders as natural drugs for centuries. It has been reported that dill included flavonoids, phenolics and essential oil (Delaquis et al., 2002). Dill has also aromatic smell and flavor depending on carrying high volatile oil.

The objective of this review is to determine the chemistry, yield and quality characteristics, and economic value of dill and its components in Turkey and the world.

Situation of dill in the World

Dill is one of the most traded medicinal and aromatic plants in the world. It is reported that dill was firstly cultivated in Europe in 1500 year, but it met with America continent in the 19th century (Small, 2006). India and Pakistan are the most important producer countries. In terms of its essential oil, the most producer countries are Hungary, the highest quality dill plants are cultivated in Egypt, Fiji, Mexico, Netherlands, United States, United Kingdom, Hungary and Germany. Pioneer producing essential oil countries are Hungary, The United States and Bulgaria (20 tons). In USA, dill is the third essential oil plants after *Mentha spicata* L. (spearmint) and *Mentha piperita* L. (peppermint). In addition, 10-15% of the world's annual essential oil production was obtained from Canada (Small, 2006; Pulur, 2012).

Situation of dill in the Turkey

While dill had the largest cultivation areas in Mediterranean Regions (4113 da), it had the smallest cultivation areas in Southeastern Anatolia (10 da) in Turkey (Table 1). In terms of production of dill, the main producers of dill plants were Mediterranean Region (4061 tones) and Marmara Region (1639 da) and followed by Aegean (671 tones) and Internal Anatolia (495 tones). The least production regions were East Anatolia and Southeastern Anatolia with 25 and 3 tones in Turkey (Table 1) (Anonymous, 2018).

Among the provinces, 32 provinces had cultivation area and production of dill in Turkey. Hatay had the most cultivation area (4035 da) and production (4027 tones) in Mediterranean region and followed by Balıkesir from Marmara in terms of cultivation area with 841 da, yet Bursa had the second production after Hatay with 882 tones. The lowest production was found as 56 tones in Ankara and

followed by Çanakkale, Muğla, Samsun with 63, 66, 75 tones among the first 10 provinces in Turkey, respectively (Figure 1) (Anonymous, 2018).

In Turkey, the Mediterranean Region has the largest cultivation area (4113 da) and the Southeastern Anatolia has the smallest (3 da) cultivation area of dill (Table 1).

Cultivation of dill in Turkey changed between 3259-7387 da between 2012-2017 years (Table 2). According to 2012 year, it was significantly getting increase both cultivation area (7387 da) and production (7208 tonnes) in 2017. Between 2012-2014 years, in Turkey, cultivation area and production values getting increase every year. After 2014 year, cultivation area and production values remained partly stable. In 2017 year, cultivation area and production values of dill had the highest level among 2012-2017 years. It is also

seen that there were very few fluctuations in cultivation areas and productions. Dill was also grown under protective cover as low tunnel, plastic greenhouse, and high tunnel. Among the 2014-2017 years, cultivation area and production of dill remained as a stable with 3 da and 3 tones in low tunnel. The cultivation areas of dill increased in plastic greenhouse (26 da) and high tunnel (55 da); its production increased in plastic greenhouse (33 tones) and in high tunnel (75 tones) in 2017 data compared with 2014 (Table 3) (Anonymous, 2018).

As a shown Table 3, the maximum production was observed in high tunnel conditions and followed by plastic greenhouse and low tunnel between 2014-2017 years.

Totally, dill was produced 7319 tones and cultivated 7471 da with under protective cover in 2017 (Table 1, 3).

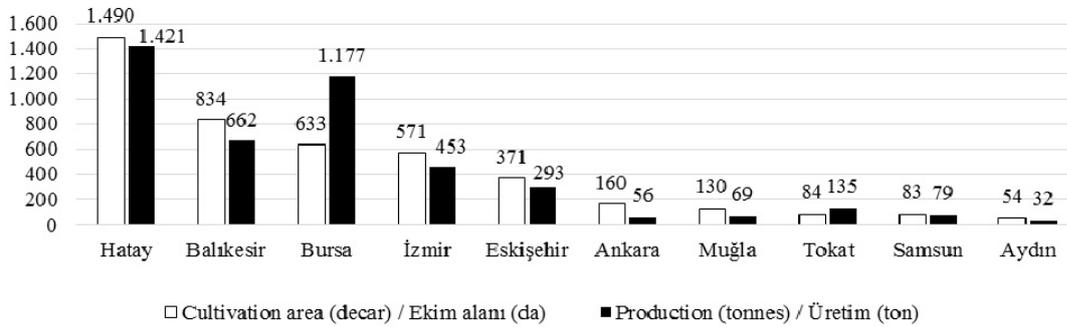


Figure 1. Cultivation area (decar) and production (tonnes) of dill among the first 10 provinces in Turkey (2017).
Şekil 1. Türkiye’de dereotu üretiminde ilk 10 ilin ekim alanı (da) ve üretim miktarları (ton).

Table 1. Cultivation areas and production of dill in Turkey (2017).

Çizelge 1. Türkiye’de dereotunun ekim alanları ve üretim miktarı (2017).

| Regions Bölgeler | Cultivation area (decar) Ekim alanı (da) | Production (tonnes) Üretim miktarı (ton) |
|--|---|---|
| Mediterranean Region (Akdeniz Bölgesi) | 4113 | 4061 |
| Marmara Region (Marmara Bölgesi) | 1439 | 1639 |
| Aegean Region (Ege Bölgesi) | 849 | 671 |
| Black Sea Region (Karadeniz Bölgesi) | 283 | 314 |
| Internal Anatolia Region (İç Anadolu Bölgesi) | 674 | 495 |
| East Anatolia Region (Doğu Anadolu Bölgesi) | 19 | 25 |
| Southeastern Anatolia Region (Güneydoğu Anadolu Bölgesi) | 10 | 3 |
| Total (Toplam) | 7387 | 7208 |

Table 2. Cultivation area and production of dill among the 2012-2017 years.

Çizelge 2. 2012-2017 yılları arasında dereotunun ekim alanı ve üretimi.

| Years Yıllar | Cultivation areas (decar) Ekim alanı (da) | Production (tones) Üretim (ton) |
|-----------------|--|------------------------------------|
| 2012 | 3259 | 2901 |
| 2013 | 4167 | 3806 |
| 2014 | 4824 | 4603 |
| 2015 | 4777 | 4488 |
| 2016 | 4763 | 4589 |
| 2017 | 7387 | 7208 |

Table 3. Cultivation areas and production of dill in greenhouse conditions in Turkey.

Çizelge 3. Türkiye’de sera koşullarında dereotunun ekim alanı ve üretimi.

| Growing conditions Yetiştirme koşulları | Years Yıllar | Cultivation areas (decar) Ekim alanı (da) | Production (tones) Üretim (ton) |
|--|-----------------|--|------------------------------------|
| Low tunnel Alçak tünel | 2014 | 3 | 3 |
| | 2015 | 3 | 3 |
| | 2016 | 3 | 3 |
| | 2017 | 3 | 3 |
| Plastic greenhouse Plastik sera | 2014 | 16 | 22 |
| | 2015 | 16 | 22 |
| | 2016 | 15 | 21 |
| | 2017 | 26 | 33 |
| High tunnel Yüksek tünel | 2014 | 45 | 49 |
| | 2015 | 42 | 50 |
| | 2016 | 38 | 51 |
| | 2017 | 55 | 75 |

Some studies about yield and quality characteristics of dill (*Anethum graveolans* L.) in Turkey and the World

There are several studies about dill in Turkey and the world. Elik *et al.* (2013) reported that in different sowing times, the yield components of dill is ranged; plant height (64.1-79.3 cm), branch number (3.2-6.3 per plant), umbel number (4.4-9.8 per plant), umbel diameter (4.6-7.3 cm) and they also indicated that fruit number per plant (172.5-210.5), fruit yield (35.6-73.2 kg/da) and fruit essential oil content (1.3-1.55%), fruit yield (35.6-73.2 kg/da), herb yield (1270.5 kg/da). Darzi and Seyed Hadi (2012) observed that plant height (72.7-77.8 cm), umbel number per plant (11.1-15.1), weight of 1000 seeds (1.48-1.58), biomass yield (2671.7-6169.7 kg/ha), fruit yield (1280.5-2196.8 kg/ha) of dill yield in Iran conditions. Khamssi (2014) have found height (90.80-97.67 cm) umbel/plant (62.6-99.3), umbellate/umbel (32-37), biomass (93.2-173.8 g/m²), grain yield (65.67-84.71 g/m²), oil essence (235.7-370.3 mg/50g DW) of dill. Agarwal (2008) reported that ratios of essential oil changed between 0.1-5.0%. The

highest essential oil was obtained from fruits and the lowest was observed from herb of dill.

When the carried out studies examined in Turkey, they showed that yield of dill changed between 1000-2000 kg/da as fresh herb and between 200-400 kg/da as a dry herb (Ceylan, 1997). It has been reported that dill contains 2.5% essential oil, 10.0% water, 305 kcal energy, 16.0 g/100 g protein, 14.5 g/100 g raw oil, 55.2 g/100 g carbohydrate and 6.6 g/100 g ash according to ASTA chemical standard and USDA food composition (Elik, 2010). In addition to this, the quality of dill essential oil depends on essential oil rates such as carvone and α -phellandren.

CONCLUSION

Dill has been used since ancient times in ayurvedic medicines such as carminative, stomachic and diuretic. It is also used as a spice and aromatic smell and flavor because of essential oil. According to data, production quantities and cultivation areas of dill have increased in recent years. The Mediterranean Region has the largest cultivation area, and the highest production in Turkey.

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