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# AVOCADO GROWING IN TURKEY

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## Summary

In this article avocado growing in Turkey was reviewed. Soils and climatic characteristics of areas suitable to grow avocado in the Mediterranean coastal belt were discussed and it is emphasized that avocado has a chance to grow in the region as well as some other subtropical fruits. Some characteristics of avocado cultivars which were commercially grown in the region and information on avocado industry of Turkey was presented. Furthermore a brief information on past and present status of research studies and economic importance of avocado were given. Finally, it was pointed out that avocado was a new but a promising fruit crop for Turkey and it would provide important contributions to the Turkish economy.

## Additional index

Avocado (*Persea americana* Mill.), Adaptation, Cultivars.

## 1. Introduction

Avocado (*Persea americana* Mill.) is cultivated in nearly 50 countries all around the world. It is also possible to grow avocado in southern coastal region of Turkey. In fact, this region represents major citrus growing belt of Turkey and it is possible to grow safely some citrus species which are sensitive to cold, such as lemon. Some tropical fruits, like banana are also cultivated in some microclimatic areas in this region.

Experiments on growing possibilities of avocado were started in early 1970s in Turkey and 4 important avocado cultivars Fuerte, Hass, Bacon and Zutano were brought from California. First experimental plantations were established with these cultivars in Antalya and Alanya. In these experiments fruit and tree characteristics, blooming period, maturity season, productivity and influence of climatic conditions on cultivars were investigated (Doğrular et al., 1983). According to the results obtained from these cultivars, some new avocado cultivars, Ettinger, Nowels, Wurtz, Corona, Reed, Regina, Edranol, Pinkerton, Stewart, Susan, Jim, Benedict, Sharwil, Santana, Jalna, Lula, Dickinson, Nabal, Chfton etc., were brought from Corsica and California in 1980s and total number of cultivars reached to 42. By using these new cultivars, adaptation trials were started in different locations of Mediterranean coastal strip. First results were obtained from these studies and published (Kaplankiran and Tuzcu, 1994-1 Demirkol, 1995).

According to the results obtained from adaptation studies, commercial avocado orchards have been established in last 10- 15 years by using firstly introduced 4 cultivars.

## 2. Soil and climatic characteristics of avocado growing areas

Since avocado is a subtropical fi7uit crop, low winter temperature is the most important limiting factor for avocado cultivation. Suitable avocado growing areas in Turkey lie between Mugla province in the south-west and Hatay province in the east in Mediterranean coastal belt. Average minimum temperatures and average annual rainfall of provinces and towns within this region are shown in table 1. In these areas, average minimum temperature changes between 5 and 11ºC in winter. In some extreme years, although it is for a short time, minimum temperature may be below 0ºC in some places. In a situation like this, avocado trees are affected by frost damage. Relatively cold resistant cultivars are preferred in those areas. Apart from that, it is recommended that growers should take some precautions for occasional frosts.

Another factor influencing avocado growing in Turkey is low temperatures at the time of flowering and fruit setting. Occasional low temperatures occurring in spring months can have negative effects on pollination and fertilization, especially in early flowering cultivars, such as Fuerte and Zutano. In addition to those, flower structure and complexity of flowering behaviour may cause to low yield. Other climatic factors seem to have no important effects on yield and cultivation.

Soil textures in avocado growing areas in the Mediterranean region of Turkey are generally as loam and clay-loam and this corresponds 3/4 of total agricultural land. Sods in this region show slightly alkaline or neutral reaction (pH 6.5-8.5) and salinity level is very low (0. 15<) in almost 90% of soils. Soils in the region contain high or very high level (15-25 % <) of lime and in terms of organic matter status of the soils are generally in a poor level (Aksoy and Köseoğlu, 1990). By considering avocado tolerant to various soil types with exception of heavy soils or those having high water table, it is possible to say that the region is suitable for avocado growing in terms of soil texture.

In this present time, horticultural crops production such as citrus, and other subtropical and tropical fruits (pomegranate, loquat, persimmon, banana) and temperate zone fruits (especially early peach, apricot, plum etc.), protected cultivation (vegetables and cut flowers) are made in the region. Apart from these crops wheat, cotton, maize, soybean, sesame and peanuts have an importance as well. Total cultivated area in the Mediterranean region is about 1.8 million hectares and 1/6 of that area used for horticultural crops. Over 110 000 hectares of area within the coastal belt covered by citrus and other fruit plantations (Anonymous, 1992). New areas are likely to be created in the region by transferring of annual crops to the newly opened GAP (South-east Anatolia Project) district and by reclaiming uncultivated areas. These actions will create new potential cultivation areas for avocado growing as well as other horticultural crops.

## 3. Characteristics of cultivated varieties

From the studies being carried out for last 20-25 years it can be seen that firstly introduced cultivars Fuerte, Hass, Bacon and Zutano can be grown commercially in the region. Thus, orchards established with these cultivars of which most of them are now more than 10 years old have come into bearing. Some characters of above mentioned cultivars observed in the region are shown in table 2. Results obtained for fruit and tree characteristics of above mentioned cultivars agree with literature findings (Bergh, 1984; Anonymous, 1987). It is possible to obtain an average of I ton crops per decarefr6nr the trees over 10 years old. In some years when weather conditions are suitable for avocado growing, yields may be more than average if one applies

cultural practices properly at the right time. Growers are advised that Hass cultivars should be planted together with Bacon and Zutano in the places where the winter temperatures rarely drop below –1ºC and Fuerte should be planted together with Zutano in the places where the temperature is favorable during the flowering and fertilization period. Experimental studies, which are in progress now with new cultivars Ettinger, Rincon, Pinkerton, Stewart and some other cultivars i.e. Santana, Susan, recently come into bearing. When these experiments are completed, these new cultivars can be used for commercial production as well.

## 4. Propagation technique

Avocado nursery trees are generally produced in government institutes in Turkey. Young trees are grown in polyethylene bags and Mexican race seeds are used as rootstock. Nursery tree propagation period is shortened from 24-30 months to 12-18 months by applying a newly developed method. In short term propagation, seeds are planted in greenhouses after following pretreatments, and later on when the rootstocks reach to grafting thickness in 5-6 months, cleft grafting is performed. Grafted plants are transferred into a semi-shaded place in 1- 1.5 months after grafting and all cultural practices and management procedures are carried out in this place. Nursery trees grow vigorously in a short time and they can be ready to plantation in autumn of the same year.

In Turkey's conditions, March - April is preferred as planting season of the nursery trees. Spacing of 6x6m or 7x7m are recommended in orchard plantation. After planting, trees are covered with different materials to protect them against sun bum, wind and cold injuries. Growers use organic manures as well as chemical fertilizers. Fertilization is recommended according to results based on leaf analysis. Orchards are irrigated during summer months, as there is no rain in this season. Other cultural practices such as tillage, pruning and control of diseases and pests are also performed.

## 5. Research studies

In Turkey research on avocado was started at first time in Citrus and Greenhouse Crop Research Institute in Antalya. Later on, other research institutes, Alata Horticultural Crops Research Institute in Mersin, Cukurova and Akdeniz University, Agricultural Faculty Department of Horticultural Crops in Adana and Antalya initiated some works on avocado as well. As mentioned earlier, adaptation experiments are in progress with imported cultivars. Studies were also carried out on propagation of avocado. One of these studies was about determination of, appropriate methods and grafting time of avocados growing Antalya region and over 80% success was achieved with the cleft and tongue graft performed in April - May (Tuzcu et al., 1990). In other study, using of 1BA in propagation of Wurtz and Duke cultivars by cuttings was investigated and 29.9 and 35.90/6 rooting rate obtained respectively in 3000 ppm of IBA concentration (Kepenek, 1994). In addition to these studies, one research program is carried out to determine type of diseases in avocado orchards. A Ph.D. thesis is now also conducted on cultivars adapted Antalya ecological conditions. In this project, rate of fruit set, observation of physiological and chemical changes in fruit during fruit set and maturity time, determination of optimal maturity time and determination of post harvest conditions are the main subjects.

## 6. Economic importance

The fruits obtained from the orchards established in early 1980s are being sold with high price at local markets and big city's markets. Furthermore, some part of the production is now exported, but there is no continuity and regularity. Although there is not any definite statistical information about production area, total production and number of trees, it is estimated that annual avocado production is around 500 tons in recent years. This figure will increase when the newly established orchards come into bearing. Presently, avocado production seems to be profitable compared to other crops grown in the region. It is possible to say that present status of Turkish avocado industry is similar to early stages of Israel avocado industry. In the near future, some positive changes are expected in cultivated areas and production. In this case, important contributions will also be provided to the Turkish economy in terms of internal consumption and exportation.

## 7. Concluding remarks

Avocado is a new but a promising fruit crop for Turkey. Ecological and soil characteristics of Mediterranean coastal belt are suitable for avocado growing. Studies started in 1970s showed that avocado can be commercially grown in the region. Fruits obtained from orchards established in the last 10- 15 years are sold at domestic and foreign markets. However the quantity of production is far from satisfactory and it is expected that there will be an increase in production in future. To achieve this, GAP region will play a major role, because in this region, 1.8 million hectare fields will be irrigated and some annual crops will be transferred from Mediterranean region to this region.

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Table 1-Average minimum temperature (°C) and annual rainfall (mm) avocado growing areas in Turkey.

| | Average minimum temperature (°C) | | | | | | | Annual |
|---|---|---|---|---|---|---|---|---|
| Locations | Jan | Feb | Mar | Apr | May | ... Nov | Dec | rainfall (mm) |
| Dalaman | 6,3 | 6,2 | 8,2 | 10,3 | 13,8 | 10,3 | 8,3 | 1107,8 |
| Finike | 7,2 | 7,4 | 8,8 | 10,5 | 13,8 | 11,0 | 8,8 | 945,3 |
| Antalya | 6,3 | 6,5 | 8,2 | 11,4 | 15,2 | 11,3 | 8,1 | 1055,4 |
| Manavgat | 6,8 | 7,3 | 8,2 | 10,6 | 13,8 | 10,1 | 8,4 | 1241,9 |
| Alanya | 7,7 | 7,7 | 9,0 | 11,4 | 14,9 | 11,7 | 9,2 | 1076,1 |
| Anamur | 8,4 | 8,3 | 9,6 | 12,3 | 15,8 | 13,3 | 10,1 | 1010,7 |
| Erdemli | 6,4 | 5,9 | 7,9 | 11,2 | 15,3 | 10,2 | 7,1 | 730,9 |
| Mersin | 5,3 | 5,9 | 7,9 | 11,6 | 15,6 | 10,6 | 7,1 | 617,6 |
| Adana | 4,8 | 5,7 | 7,8 | 11,2 | 15,0 | 10,6 | 6,7 | 663,2 |
| Dörtyol | 6,8 | 7,5 | 9,4 | 12,8 | 16,6 | 12,8 | 8,6 | 987,5 |
| İskenderun | 8,4 | 8,9 | 10,5 | 13,9 | 17,7 | 14,2 | 10,3 | 756,9 |
| Samandağ | 6,1 | 7,4 | 10,6 | 13,5 | 17,2 | 12,7 | 8,5 | 1008,5 |

Source: General Directories of State Meteorological Affairs, Meteorological Bulletin 1974-1984.

Table 2- Characteristics of commercially recomended avocado cultivars in Turkey.

| Cultivars | Fruit Size(g) | Fruit Shape | Oil Cont. (%) | Edible Por.(%) | Blooming Period | Maturity Season | Yield* (kg/per tree) |
|---|---|---|---|---|---|---|---|
| Fuerte | 208-305 | Pear | 15,30 | 73,00 | 31 Mar - 31 May | 1 Nov - 15 May | 50,10 |
| Hass | 175-215 | Ovate-pear | 14,10 | 68,00 | 30 Apr - 31 May | 1 Jan - 30 Jun | 51,90 |
| Bacon | 255-320 | Ovate | 14,20 | 73,00 | 1 Apr - 31 May | 1 Nov - 15 Jan | 34,90 |
| Zutano | 270-310 | Pear | 13,80 | 71,00 | 31 Mar - 31 May | 1 Nov - 31 Dec | 54,00 |

*Observation of 10years old trees average yield.