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Present status and future prospects of underutilized fruit production in Turkey

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SUMMARY - Turkey, as a country possessing different climates and lying in a passageway between the two rich gene centers, the Caucasian and the Mediterranean, bears many fruit species. Among them, some of the fruits known as underutilized fruit crops in other countries like the fig (*Ficus carica*) and the pomegranate (*Punica granatum*) have been traditionally produced and consumed for centuries. On the other hand, the production of loquat (*Eriobotrya japonica*) and Japanese persimmon (*Diospyros kaki*), which were introduced later, show an increasing trend. The Barbary fig (*Opuntia ficus-indica*) still remains to be a wild species.

Key words: Barbary fig, fig, Japanese persimmon, loquat, pomegranate.

RESUME *- La Turquie relie deux régions de grandes richesses génétiques (la Méditerranée et la Caucasie) et présente une grande diversité climatique. Pour cette raison, de nombreuses espèces fruitières y sont cultivées. Certaines de ces espèces comme le figuier (Ficus carica) et le grenadier (Punica granatum), sont cultivées et leurs fruits sont consommés depuis des siècles, alors qu'elles ne sont pas utilisées dans d'autres pays. D'autre part, la production de nèfles du Japon (Eriobotrya japonica) et de kaki (Diospyros kaki), introduits plus tard en Turquie, a une nette tendance à augmenter. Le figuier de Barbarie (Opuntia ficus-indica) est encore considéré comme espèce sauvage.*

Mots-clés *: Turquie, figue, grenadier, néflier de Japon, kaki, figuier de Barbarie.*

Fig (*Ficus carica*)

Present status

Turkey is the major fig producer in the world. According to 1990 figures, the number of fig trees total to 10 843 000 and the production to 300 000 MT (State Institute of Statistics, 1993). Most of the production comes from the Aegean Region which is located in the western part of the country (Table 1).

The fig plantations in the Aegean Region are mainly composed of (99.98%) Sarilop variety. It is also known as Calimyrna and is a variety possessing high dried fruit quality. The crop produced in the Aegean Region is commercially sun dried, mostly for the export market. Although a small portion of the Sarilop production goes to the fresh market, its fresh quality is inferior. EC countries are the major group in dried fig importation.

Table 1. Production (figures of 1990 as number of trees and production MT) of underutilized fruit crops in various regions of Turkey (State Institute of Statistics, 1993)

Region	Fig # trees	Yield (MT)	Loquat # trees	Yield (MT)	Pomenagrate # trees	Yield (MT)	Persimmon # trees	Yield (MT)
Mid-north	51 160	652	-	-	97 345	1 739	3 160	55
Aegean	8 560 558	247 517	9 250	195	823 511	17 843	2 315	71
Marmara	283 952	6 589	-	-	24 755	304	13 075	439
Mediterranean	1 134 665	29 678	242 885	8 706	891 386	19 722	302 400	7 898
North-east	32 455	492	650	6	11 550	153	11 720	195
South-east	255 508	3 025	-	-	588 937	8 237	30	-
Black sea	409 155	10 718	8 215	93	38 965	428	37 300	1 342
Mid-east	87 947	930	-	-	46 381	536	-	-
Mid-south	27 800	399	-	-	43 170	1 038	-	-
TOTAL	10 843 000	300 000	261 000	9 000	2 566 000	50 000	370 000	10 000

The fig plantations are established by rooted hardwood cuttings with a between and on row spacing ranging from 10 x 10 m in older low-land orchards to 5 x 5 m on the slopes. Thus, the average yield per tree varies from 6 to 20 kg on dried fruit basis according to the vigour of the tree. Although an increasing trend in the number of fig trees is apparent, the most important change has been observed in the shifting of the fig plantations from the low lands to the steep slopes during the last two decades. Most of them are rain fed, only in two locations, supplementary winter irrigation is practised. 'Sarilop' variety is a 'Smyrna' type fig requiring fertilization of the fruit by a process called caprification in order to set, develop and mature fruits. In the Region, the male (caprifig) fig trees are found as scattered trees, being more concentrated in some villages which sell caprifig fruits on a commercial scale. Male fruits are picked when their pollens ripen (generally during the second half of June) and then hung onto the female trees with the help of a weed stem. Caprifig fruits are known to be vectors of some fungi causing internal rot; therefore, precautions need to be taken in order to produce healthy male fruits.

In the Aegean Region, a clonal selection within 'Sarilop' was started and 86 clones were selected (Eroğlu, 1982). The evaluation of these clones was completed in 1994 (Aksoy *et al.*, 1994) and some clones which are superior in overall quality (lesser cull ratio, larger fruits with lighter skin color and softer texture and shorter maturation period) were selected. A group of studies carried out in order to determine the leaf nutrient status of the Region helped to put forth the levels which can be used as reference values for the Sarilop variety (Aksoy *et al.*, 1987; Anaç *et al.*, 1991; Eryüce *et al.*, 1987).

The studies performed in the Big and Small meander valleys in order to find out the correlations between plant nutrients and fruit quality showed that potassium/calcium ratio exerted significant effects on the incidence of crack (split) and sunscald. As the ratio was increased the ratio of cracked fruits increased and as the ratio got smaller then the number of sunscalded fruits increased (Aksoy *et al.*, 1987; Anaç *et al.*, 1991).

At the Fig Research Institute (Erbeyli-Aydın), there is a collection garden comprising 272 fig varieties mainly for fresh consumption together with the 86 'Sarilop' clones and 51 native caprifig varieties. Most of the cultigens were collected from different parts of Turkey. There are only five foreign cultivars. Fig collections are present at Ege, Uludağ and Çukurova Universities and Erdemli Horticultural Research Institute. These collections are established mainly to evaluate the performance of the well known varieties under the prevailing conditions, and up to now promising results have been derived. Being an important crop for the Region, fig has been the subject of various researches for many years, mainly on drying, processing, propagation, and plant protection.

In Turkey, fig trees are common in all of the coastal areas, however, the climatic conditions prevailing especially during the fruit maturation and drying period limit the production of dried figs on commercial basis. Due to the high humidity levels (as in the Mediterranean Region), it may not be possible to get sound and intact fresh fruits in some crack-susceptible varieties. Among fig varieties there is a significant variation in terms of crack resistance (Aksoy and Akyüz, 1993) therefore the right selection of the variety will ensure a good crop in coastal areas.

Fresh fig production with the exception of the three locations in which intensive production has already been started (Bursa, Salihli-Manisa and Mut-İçel) is mainly from the scattered trees and for the local markets. However fresh figs from the well established orchards in these three locations are generally exported. The major export markets are Saudi Arabia, Germany, England, France and Holland; and the fresh fig exportation to these countries according to the figures of 1992 (IGEME, 1993) are 1,207, 926, 432, 393, and 361 MT, respectively. In terms of fresh fig production, the Mediterranean coast may have a great potential in terms of early breba crops due to the high humidity levels in July and August and milder climatic conditions favouring earliness.

Future prospects

Although dried figs obtained from 'Sarilop' cultivar has been a traditional crop for the Aegean grower, problems due to poor quality are still on the agenda. Factors that have adverse effects on fig production including the drought conditions during the last five years and their impact on the vegetative growth, yield and quality are already identified, however, the solution lies in the modernization and improvement of the infrastructure that needs investment. Production of healthy nursery stock from the selected 'Sarılop' clones may help to solve the problems. The microclimatic conditions that provide the highest dried fruit quality is already set up so the future prospect could be increasing the yield and quality per unit area rather than expanding the acreage.

The fresh figs can be grown in all the coastal areas. Establishing intensive orchards with different varieties (starting with the Breba crop and ending with the late ripening ones) and at different latitudes and altitudes will provide the opportunity to extend the marketing season. Aksoy *et al.* (1994) have recommended early (Breba), early-mid, mid-season and late ripening varieties from 183 'native cultigens' for the Aegean Region. Adaptation trials should follow these studies in order to observe the effect of environmental conditions on fruit quality. Parthenocarpic varieties bearing one or two crops per year should receive more attention. Pruning trials should be performed with the varieties grown for the Breba crop in order to increase the yield per tree.

In the world market, there is an increasing demand for fresh figs therefore production with standard varieties accompanied by advanced handling, packaging and transportation facilities will enable to establish a strong and long lasting chain between the producer and the consumer.

Loquat (*Eriobotrya japonica* Lindl.)

Present Status

Loquat (*Eriobotrya japonica*) was introduced to Anatolia 150 to 200 years ago possibly from Algeria or Lebanon (Demir, 1987b). Until the last decade, loquat growing was carried out only in the isolated home gardens and for local consumption. After noticing its market value, the demand for its commercial production has rapidly increased. The total production in 1980 (3,000 MT) was increased more than two-fold by 1985 (6,500 MT) and three fold by 1990. In 1990, the total production was about

9,000 metric tons obtained from 261,000 trees (Table 1). In the statistical figures, there are significant yearly fluctuations in terms of tree numbers due to the frost damage or to the pulling out of the orchards established by seedlings and consequent establishment of more intensive orchards with new cultivars bearing abundant and high quality fruits. In Turkey, 92.7% of the plantations are located in the Mediterranean Region lying in the southern part of the country. Even within the Mediterranean Region, Antalya and Icel provinces seem to be the major producers. In the Aegean Region, loquat growing is limited only in microclimates mainly in Sultanhisar-Aydın.

In order to provide healthy data for such a rapid change, a trial was established at the Citrus Research Institute (Ministry of Agriculture and Rural Affairs) based in Antalya between 1968 and 1981 with 12 local selections and 5 introductions. As a result, 'Akko XIII', 'Gold Nugget', 'Tanaka' and 'Hafif Çukurgöbek' were selected as the most suitable varieties and recommended for commercial production. The pollination requirements of these varieties and suitable pollinators were determined as well. An adaptation trial was replicated in 7 different locations, 6 being in the Mediterranean and 1 in the Aegean region with the selected cultivars together with 6 new introductions from Corsica ('Ottowiani', 'Baffico', 'Victor', 'Taza', 'Kanro', 'Champagne de Grasse') (Demir, 1991).

The older loquat orchards were established mainly by seedlings however the new and more intensive orchards are being established by the selected varieties on seedling rootstocks. Researches on the seed storage conditions and propagation techniques revealed that under favorable conditions, seeds could be stored safely for 9 months and still keep their viability. The most convenient period for budding was the beginning of March to mid-May and patch budding proved to be more satisfactory than the shield and chip budding (Demir, 1987a). Polat and Kaşka (1992) report that stratification and storing seeds at 4°C exerted significant effects on the germination rate. Taking into account the susceptibility of loquat to high soil calcium content which is very often seen in the Mediterranean Region, a research has been started by Demir (1994) to test the performance of some important loquat varieties on quince (A and C), loquat seedlings and *Cratageus spp.*. Most of the nursery stock, on quince rootstocks died with the exception of 'Akko XIII'.

In general, the regular loquat orchards are established with a spacing of 7-8 m and with more than one variety. Cultural practices (especially pruning and spraying against apple scab) are applied regularly in intensive orchards. Irrigation is carried out generally as basin irrigation.

In Turkey, loquat is consumed as an early season fresh fruit. The production is not adequate for the domestic consumption but some parties are exported mainly to Kuwait, Jordan, Germany, Austria, Sweden and other European countries. The exportation is not stable, the total loquat exportation was 33.3 MT (50% to Kuwait) in 1990, 147.0 MT (30% to Germany and 30% to Jordan) in 1991, 47.2 MT (25% to Kuwait and 30% to Germany) in 1992 and 30.2 MT in 1993 (IGEME, 1993).

Future prospects

Loquat fruits appear in the Turkish market early in the spring when there is a shortage of fresh fruits therefore the unit prices are quite high. As the production increases due to high yielding cultivars and more intense plantings, the production costs can be pulled down providing an increase in the domestic consumption and in the chance of exportation. At present, the western Mediterranean Region seems to be the center of production however available land can be a limiting factor, competition being on one hand with tourism and on the other hand with alternative crops with a higher return like citrus or glasshouse production of ornamentals and vegetables. Introduction and adaptation studies parallel with research on hybridization (Durceylan and Demir, 1993) to obtain high yielding varieties with large and high quality fruits, resistant to diseases mainly to apple scab and to handling and transportation practices may bring solution to the problems present in loquat production. The main factor limiting the production still remains to be the climatic conditions, the minimum temperature and the risk of frost.

Pomegranate (*Punica granatum*)

Present status

Pomegranate production in Turkey is realized in three regions: the Mediterranean (35.7%), the Aegean (39.4%) and the south eastern Anatolia (16.5%) (Table 1). The properties that the pomegranate possesses like the ease in vegetative propagation, wider adaptability to different soil and climatic conditions, long shelf life and resistance to handling and transportation practices have made it a widely spread species. In Turkey, pomegranate is accepted as an indigenous species. A study that was carried out on 72 local cultigens revealed that the varieties can be classified into three groups according to some common pomological characteristics as: sweet, sour and pleasantly acid. Within each group, the cultivars were identified as early, mid season and late by dividing the total harvest period in the Mediterranean Region (August 20- October 20) into three (Onur, 1982).

Regular pomegranate plantations were present especially in the regions where it has economic importance, however, in the other regions they were either placed as border trees or as single trees. In Turkey, the fruit bearing pomegranate trees were 983,000 and non-bearing 216,000 in 1973 and the production was 26,000 MT. These values increased towards 1978 but decreased then after until 1987. Since 1987, the values have doubled and the production has reached to 50,000 tons in 1992. The yearly exportation of pomegranate was calculated as 568 MT in 1990, 709 MT in 1991 and 548 MT in 1992. The major importers are Germany, Austria, United Arab Emirates, Belgium and Denmark. The importation does not seem to be significant. Onur (1990) reports that the Arabic countries prefer sweet pomegranates whereas the European countries pleasantly acid ones with a red rind and kernel color. The sour and mildly acid pomegranate varieties are grown mostly in the Mediterranean and the south-east, the dominating cultivar being 'Hicaz'. The yield per unit area in the south eastern Anatolia is lower compared to the Mediterranean and the Aegean regions. The selection studies carried out by Onur (1982) mainly consisted of the local cultigens of the Mediterranean. This study was followed by the adaptation studies performed by

the 20 cultigens selected from the Mediterranean Region. The results show that in general, varieties had rather thick peels and poor color formation resulting in lower quality. The early ripening cultivars, on the other hand, had fruits smaller than the sizes demanded by the market. In all the other cultigens average fruit weight exceeded 400 g (Onur, 1991).

In the Aegean Region, two researches were carried out in order to determine the pomological properties of some well known pomegranate varieties under the prevalent conditions by Dokuzoğuz and Mendilcioğlu (1978) and Baldıran and Ercan (1988). Although the significance of the Aegean Region in the pomegranate production has declined during the last ten years, recommendations are necessary for the rising interest.

The pomegranate orchards are established by rooted hardwood cuttings. The spacings vary between 2 to 6 m, 2 m is preferred mainly in the case of border trees. 2.5 x 4 m or 3 x 4 m between and on row spacings are the most frequent ones. In southeastern Anatolia, 4 nursery trees are planted as a group followed by the second group after a space of 5-7 m (Onur, 1988). The natural growth habit of the pomegranate is bushy and the trees are generally trained as multistem (3-4 stems). Irrigation schemes are very important in terms of fruit cracking. The widely applied method is the furrow irrigation.The research projects carried out at the Citrus Research Institute (Antalya) include a trial on fertilization of pomegranate trees in which N is tested in the range of 0-600 g/tree/year, P_2O_5 0-440 g and K_2O 0-400 g (Özkan *et al.*, 1994).

The pomegranate fruits are easy to handle due to a rather thick rind. However, plastic bags or different storage conditions were found to exert significant effects on the weight loss occurring mainly on the rind (Onur and Pekmezci, 1993). Studies on the evaluation of the pomegranate juice and the concentrate have already started in Turkey (Dağlı, 1991).

Future prospects

Pomegranate as a species with a wide adaptability to different soil and climatic conditions can have a great potential. The first requirement for future planning can be establishing regular orchards with standard varieties. The intensive studies carried out under the Mediterranean conditions have resulted in dense plantations established by 'Hicaz' variety. Further selections and adaptations need to be carried out in the Aegean Region and the South-eastern Anatolia. The varietal selection, introduction and adaptation trials should be continued especially in terms of sweet and soft seeded varieties.

The pomegranate fruits can be used in processing as well. However, in Turkey its industrial use need to be developed. As the fields in which pomegranate or its by-products can be used as raw materials are increased, the production can be expected to increase to a larger extent.

During the last five years, the number of pomegranate trees in Turkey seems to remain at the same level mainly because less fruitful border trees are being replaced by the new intensive orchards. For the near future, an increase in production of

pomegranate is estimated after the regular orchards start bearing. Parallel to this increase, exportation figures are expected to increase, as well.

Persimmon (*Diospyros kaki*)

Present status

The persimmon together with the loquat is of minor importance compared to the fig and the pomegranate. Although it is widely spread in the Mediterranean Region, the main producer provinces are located on the eastern part of the Region. The persimmon is produced also in the Black Sea Region, northern Anatolia. The mountains lying parallel to the Black Sea line provide a rather mild and humid climate in a narrow strip of land enabling the production of subtropical species.

In the coastal areas of the Mediterranean Region, persimmon can be found at the market for about 7 weeks starting from the third week of September with the early varieties and continuing until mid November. The fruits of the late ripening varieties remain on the tree even after the leaf fall. In Turkey, almost all of the commercially grown varieties have an astringent taste. Besides, their fruit flesh color darkens parallel to the number of the seeds formed in case of pollination. The first trials on Japanese persimmon was started in 1984 at the Citrus Research Institute in Antalya. These researches carried out in collaboration with the Alata Horticultural Research Institute (İçel) and aiming to select the cultigens present in the western Mediterranean Region resulted in 6 types that have high quality fruits including 'Fuyu' and 'Hachiya'. 'Fuyu' and 'Hachiya' were introduced to Turkey in 1969 through FAO. The fruit ripening periods of these selections vary between 9 to 30 October (Onur, S., 1985; Onur and Taşdemir, 1987). At Çukurova University Department of Horticulture, a collection comprising 68 cultigens (5 x 5 m apart and 5 replications) from local selections and Italian, Japanese and Pakistani introductions was established. Adaptation in the southern and south eastern Anatolia and selection studies among local types especially in the Black Sea Region are still being carried out.

In the western Mediterranean, persimmon trees are grown as seedlings mostly within the home gardens in villages or towns near the cities. In the eastern Mediterranean regular orchards are more frequent. *Diospyros kaki* is used as the rootstock. There is no commercial use of *D. lotus* in Turkey. At Çukurova University, a trial was started to compare the performance of *D. kaki* seedlings, *D. lotus* and *D. virginiana* as rootstocks. A spacing of 5 x 5 m or 6 x 5 m is recommended for establishing a regular orchard. Windbreaks are in case of heavy winds. The amount of irrigation water and the irrigation scheme is of vital importance especially in the Mediterranean Region (Onur, S., 1990).

Future prospects

Persimmon is a fruit species which is overlooked in Turkey as a new commodity to widen the spectrum of exportation. On the other hand, the production can not fulfil even the demands of the domestic market. The studies aiming to select high performing varieties and determining the suitable areas for production should have

priorities. Researches on the propagation of healthy nursery stock and on the cultural practices need to be carried out, as well.

Barbary fig (*Opuntia ficus-indica*)

In Turkey, Barbary fig is grown wildly in the south-western and southern (Mediterranean) parts of the country. Its fruits are sometimes picked to make a kind of jam. In the future, its production can be expected to increase if there is a demand for its fruits. As a species resistant to dry and calcareous conditions, it can create a great potential for the future.

Conclusion

In Turkey, the production of the five fruit species seems to be limited to the Mediterranean, Aegean (especially in respect to fig and pomegranate production) and partially to the Black Sea (persimmon) regions. However, microclimatic conditions that affect the production and the quality of these species need to be searched. The agricultural faculties (Çukurova, Ege and in the future Akdeniz) constituted in these regions have already established collection gardens in order to collect data in terms of adaptation and introduction of the new cultigens. The three research institutes of the Turkish Ministry of Agriculture and Rural Affairs; the Citrus Research Institute in Antalya (pomegranate, loquat and persimmon), Alata Horticultural Research Institute in Erdemli-İçel (persimmon) and the Fig Institute in Aydın (fig) have larger collections on related species. However as mentioned above, many points still need to be solved and search for the new high performing varieties should continue.

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