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POSTHARVEST HANDLING OF FRUIT AND VEGETABLES IN TURKEY

Kenan KAYNAŞ[1]

[1]Çanakkale Onsekiz Mart University. Faculty of Agriculture. Terzioglu Campus. 17020. Çanakkale. Turkey

Corresponding author email: kenankaynas@gmail.com

Abstract

Turkey is the unique country that has land in both Europe and Asia. Turkey has approximately 75 000 000 population and is an agricultural country. In this context Turkey has great fruit and vegetable production potential. Turkey is one of the biggest producers of apples, pears, quinces, peaches and apricots, citrus (as fruit species) and tomatoes, peppers, melons, watermelons (as vegetable species). However, the amount of cold stores and packinghouses is deficient for its potential. Moreover the export rate is 5-10% of production. In addition the rate of postharvest losses of these crops is approximately 35-40%. On the other hand, the usage of controlled atmosphere (CA) stores and new postharvest technologies debouched rapidly. As a result increasing the amount of CA stores and modern packinghouses, arranging the errors in cold chain and improving the reproducing conditions will make Turkey an important fresh perishable exporter. Besides, the potential and capacity of production will be validated by minimizing the postharvest losses. On the other hand, cave storage will be improved by some modifications such as temperature, humidity and air circulation conditions. Their numbers, and hence capacities are steadily increasing. Eventually, the cave stores have impressions as being the predominating stores for citrus, potatoes and onions.

Key words*: Turkey, horticultural production, postharvest losses, postharvest technology.*

INTRODUCTION

STATUS OF HORTICULTURAL SECTOR

Turkey is blessed in the production of wide range of fruits and vegetables of which many are indigenous to the area such as pears, quinces, cherries, plums, grapes, walnuts, hazelnuts and pistachios. Of the total cultivated land, fruits and olives trees including vineyards occupy 3.012 million ha (11.0%) whereas vegetables 0.663 million ha (2.4%). It is estimated that 75% of vegetable fields and probably 40-50% of fruit, vine, olive orchards are irrigated. Although the land has nearly remained stable over the last decade the total production of horticultural produce increased from approximately 24 million tons to over 45 million tons (1990-2010). This may have been largely due to increase in large bearing orchards, and for vegetables, improved cultural techniques and high yielding varieties. Table 1 and Table 2 show figures on main fresh fruits and vegetables. Total annual fruit production was 9 million tons in 1990 and is probably around the 15-16 million tons in recent years. Total annual vegetable production was around 22 million tons in 1990 and is probably 30 million tons in recent years. Estimated export rate of 5-7% for fruits and vegetables reveals 1.5 million tons fruits and 1.8 million tons of vegetables are exported. Intensive production of fruits and vegetables is concentrated in the Mediterranean, Aegean, and Marmara Region as well as the central plateau, hazelnuts in the Black Sea Region, and pistachio in the Mediterranean and Southeastern Anatolia Region. Protected cropping is concentrated in microclimatic zones along the Mediterranean coast and Aegean Region. In these areas 90% of the total protected culture is used for vegetables, 7% for cut flowers and indoor plants, and 3% for fruits yield (strawberries, bananas, peaches).

The objectives of the Government for the development of horticultural sector have been mainly concentrated on: a) Modernizing production techniques to increase productivity and growers income, b) Producing highest quality of fruits and vegetables as possible, c) Meeting the food requirements of persistently increased population, d) Promoting horticultural exports as a result of oversupply.

In fact, many economic policies and reforms initiated by the Turkish government in the early

1990's and reviewed in 2002 have encouraged growers, private sector and market forces as well as exporters, as a result of which overall horticultural production has reached 45 million tons a year.

Table 1. Fruit production in Turkey (tons).

Year	Apple	Pears	Quince	Louquats	Peaches	Plums	Apricot	Cherries	Sour cherries	Cornel	Olive
1990	1900000	413000	79000	9000	350000	188000	240000	143000	90000	17000	1100000
2000	2400000	380000	105000	11500	430000	195000	530000	230000	106000	12000	1200000
2010	2600000	380003	121085	12112	539403	240806	450000	417905	194989	12517	1352827

Year	Almonds	Hazelnuts	Walnuts	Chestnuts	Pistachios	Mulberry	Pomegranates	Strawberries	Persimmon
1990	46000	375000	115000	80000	14000	80000	50000	51000	10000
2000	47000	470000	116000	50000	75000	60000	59000	130000	12000
2010	55938	600000	178142	59171	128000	75096	208502	299940	26277

Year	Oranges	Mandarin	Lemons	Grape fruits	Kiwi fruits	Bananas	Figs	Grapes	GrenTea Leaves
1990	735000	345000	357000	33000	-	36000	300000	3500000	608440
2000	1070000	560000	460000	130000	1400	64000	240000	3600000	758038
2010	1710500	858699	787063	213768	26554	210178	254838	4255000	1305566

Table 2. Vegetable production in Turkey (tons).

Year	Tomatoes	Cucumber	Pepper	Eggplant	Okra	Squash	Pumpkin	Melon	Water melon	Pea (green)
1990	6000000	1000000	900000	735000	22000	294000	57000	1650000	3300000	37000
2000	8890000	1825000	1480000	924000	27500	260000	72000	1865000	3940000	48000
2010	10052000	1739191	1986700	846998	36748	314340	89368	1611695	3683103	90191

Year	Bean (green)	Calavence	Cowpea	Broad beans	Cabbage	Lettuce	Artichokes	Celery	Cauliflower	Broccoli	Spinach
1990	430000	31000	-	62000	699000	186000	10000	12000	68000	-	160000
2000	514000	41000	12000	45000	725000	333000	24500	16500	90000	-	205000
2010	587967	70614	16591	41929	693012	419298	29070	1534	158579	26493	218291

Year	Cultivated mushroom	Onion	Garlic	Leek	Carrots	Radish	Purslane	Parsley	Mint	Dill	Rocket	Cress
1990	-	1736000	95000	340000	168000	71000	4000	-	-	-	-	-
2000	-	2428000	102000	308000	235000	167500	2250	40000	5000	1700	1150	1250
2010	21559	2065478	98170	244812	533253	155673	4936	56332	11772	2978	4058	2380

These measures and programs have an "open-end" potential (increases 100%, 200% or more) in contrast, however to "close-end" potential defined as postharvest technology and handling.

After realizing that estimated losses of horticultural crops running at 25-30% in Turkey more emphasis has been given to the postharvest handling systems in the last two decades.

POSTHARVEST SYSTEMS AND HANDLING PRACTICES

Postharvest systems and handling was first introduced in Turkey in the early 1960's by Prof. L. Lary Claypool from the University of California Davis. Now many people working at the Universities and Ministries have specialized in the postharvest field and carrying out research and training programs on horticultural crops.

In Turkey, most fruits and vegetables the higher temperature during the growing period the earlier the time of harvest. Long hot summers especially predominating in the South create sunburn problems on produce, thus detracting from quality. Sunburned crops may show symptoms of sun scald if they are stored too long like apples, pears, tomatoes, peppers etc. As a result some pome fruit varieties on dwarf rootstocks are growing with shading net systems recently. Russeting is another environmental problem in coastal regions. If leaf overlapping cannot avoided, tomatoes and many fruits as well as citrus, pome and stone fruits are highly affected for quality. Frost and hail damage cripple the yield and quality on many fruits and vegetables in some years.

Overhead sprinkling and mixing overhead fans are used for late spring cold injury especially.

More recently, Ministerial and some private organizations have development laboratories and mobile analyses units to help growers solve nutritional problems. But some postharvest physiological disorders connected with nutritional imbalances have a big problem still especially for pome fruits storage. All the calcium deficiency related disorders which appear during storage and during marketing have nearly been prevented. Foliar application of their salts has been a common practice by the growers on apples, pears, quince, tomatoes and pepper.

At the moment, extensive research studies conducted by the universities as well as by the Ministries Institutes have well established the use of growth regulators to increase produce quality. But, the use of growth regulators may have limited use due to harmful effects on human health, in practice. Also there are well established toxicology laboratory in some regions, for residue analyses on exporting fresh crops.

Many research studies are in progress relating preharvest cultural practices to the postharvest produce quality. Variety evaluations, dwarfing rootstocks, effects of pruning and thinning, mulching, soil cultivation and pollination are some areas being explored and the results are disseminated to growers and extension personnel for useful implementations.

Today, in Turkey, as in the past this is achieved through the hand harvesting in all horticultural crops except in the processing industry. There is no doubt that humans can accurately select for maturity, allowing accurate grading and multiple harvest, can handle the commodity with a minimum damage. Mechanical harvesting is practiced to great deal on sweet corn, potatoes, onions, olive, tomato paste production, juice and canning production.

Postharvest losses occurring quantitatively and qualitatively in all phases of post-production cycle (cold chain) are in the vicinity of 35-40%. Fruits and vegetables are generally only cooled by packers and exporters when products are to be transported over long distances. Cooling operations are nevertheless simple and carried out mostly in cold – rooms and far from being technologically development. Since much of the produce is locally sold, cooling is not commonly practiced, because it is expensive and losses are not considered excessive. The cold chain from producer to consumer is frequently interrupted due to lock of efficient facilities such as packing houses, cold stores, cold transport and cool market operations and distributions. Following the harvest fruits and vegetables in Turkey are destined for either storage or market. Preparations for both destinations are mostly done in the field, in the packing shed or in a covered area. Preparations include, receiving, cleaning, trimming, sorting, hand grading, sizing and packing (Figure 1).

Figure 1. Classical fruit cold storage, handling and packaging for apple

Only small production goes through the modern packinghouse operations where the sequence of operations varies with different crops packing houses were mostly in operation nearby big consumption center and also founded nearby shipping port. Major provinces were İzmir, Antalya, Mersin and Istanbul which nearly equally shared the total by 40% each. In general, sorting and sizing of products are made according to their physical properties such as diameter and weight. Some of them have been graded objectively the produce by color. So, many modern packinghouses mostly handling vegetables are operative in Marmara Region. They are equipped with modern machinery and annexed with cold storage. They are mostly owned and operated by the exporting companies. Many cold stores and packinghouse build to handle 5 000 – 10 000 tones in during the last 10 years, especially to handle postproduction phase of pome and stone fruits.

Some forms of deterioration, such as sprouting, water loss, storage disorders, insect manifestations and fungal rots can be minimized with chemical treatments before storage or marketing. Antitranspirants, surfactants and other skin coating agents and ethylene absorbents such as 1-methylcyclopropene (1-MCP), aminoethoxy vinyl glycine (AVG) are being investigate by research laboratories and their commercial use is to be spread. Such studies implicated plant nutrition studies and research efforts have yielded results of practical implementations. Field applications are widely practiced but their postharvest use before storage is limited due to lack packinghouse operations or simple machinery which can be used in packing sheds after harvest. Along this line, commercially scald is significantly reduced by the postharvest dip in diphenylamine (DPA) especially Granny Smith apples and domestic pear cultivar Deveci, Anjou and Abbe Fetel. Nevertheless, the growers in Turkey are showing keen interest on pre-storage treatments with chemicals including the fungicides, since fungal rots contribute to postharvest losses at the highest rates.

Hydrocooling and forced-air cooling systems are used by several modern cold stores in Turkey (Figure 2). Turkey could gain great advantage their upon reduce postharvest losses especially during marketing if wholesale and regional markets as well as ever increasing supermarket chains are furnished with compact ice-bank cooling units.

Figure 2. Hydrocooling for cherry and DCA (Dynamic Controlled Atmosphere) atmosphere storage for apple

Curing of potatoes, onions and garlics is done in the field in Turkey where harvest time is characterized by hot and sunny days with concurrent low humidity levels. It is reasonable to believe that such in-field curing may create problems resulted from excessive heat, lack of

aeration, soil-born diseases and field rodents and other pests. These factors obviously shorten the storage life and contribute the high rates of postharvest losses likely to occur in these crops at the vicinity of 35-40%. Proper temperature, humidity and air rate levels required for curing of onion and garlic have been obtained but these are limited practically.

The purpose of fresh fruits and vegetables storage in Turkey is not different than anywhere else in the world. Storage of fresh fruits and vegetables prolongs their consumption and in some cases even improves their quality. Even using the most modern cold stores, expectations of growers or handlers in Turkey sometimes are crippled due to high rates of storage losses because they ignore the fact that each member ring of the cold chain should be tightly bound to the next one and storage alone, as a separate ring, cannot improve the condition unless other former rings i.e., preharvest factors, harvesting and handling practices, precooling, packaging and hauling have been orderly and properly fulfilled.

Mechanically refrigerated stores capacity is about 750.000 tons in Turkey. Controlled atmosphere stores are a new concept for Turkey but it is progress because of storage quality, prolongs their consumption and price of crops at off-seasons. Only apples are stored in CA for 9 months (Figure 2).

The simplest of the alternative storage source but least practiced in Turkey is keeping the produce on the plant or, in situ for few months after they attain maturity. This is particularly applied on few citrus species, persimmon, grapes in certain areas, and among the vegetables, potato, carrot and garlic. Grapevines are individually covered with clear plastic as protection from early frosts.

Usually, some vegetables are stored in pits and trenchers by covering their surface with soil. Pits are used for storing potatoes, carrots, turnips and lesser extend on cabbage.

In some areas insulation with straw, hay or even manure is practiced when cold winter prevails. These varieties are mostly local and have no commercial value.

Cave storage can play an important role in storing some durable fruits and vegetables in regionally “Cappadocia Valley” which is historical place (Figure 3).

Their numbers, and hence capacities are steadily increasing.

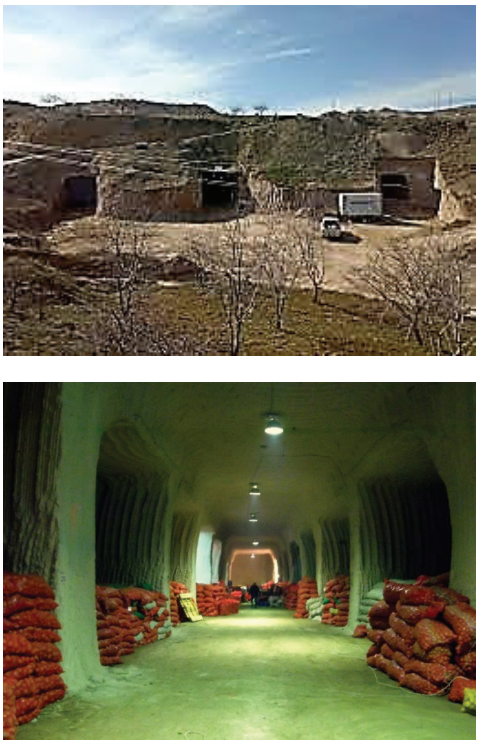

Figure 3. Cave stores in Cappadocia Valley for potatoes storage

Eventually, the cave stores have impressions as being the predominating stores for citrus especially for lemons.

Much of the produce of lemons, oranges and grape fruit grown in the Mediterranean Region is shipped out to the area for subsequent storage. It is customary the hose the surfaces inside the store with water to provide extra humidity apples are to be stored. The floor is also watered occasionally. Potatoes and onions are kept in rather less humidified caves in different dimensions. Walls are usually 1.0-1.5 meters wide. Aeration is achieved by natural convection. The doors are opened early in the morning when the ambient air is cold and entering air flowing around the stacks of produce, leaves the cave through the pipe flues. Temperature inside the cave should not deviate so much and probably stays near the average annual ambient temperature. The overall storage capacity of these caves is near 700.000

tons all located within the provincial borders of Cappadocia Region To reduce overall postharvest losses in these cave stores some modifications appear to be essential. A refrigeration, heating unit and mechanically ventilation and inside circulation of air are indispensable.

The present situation of the postharvest system in Turkey is as follows: a) Small scale production mostly on fragmented land involves high physical handling, transportation and transaction costs, b) Postharvest losses are as high as 30%, c) Too many intermediate agencies in marketing the produce each demanding payment for their services, handling small lots generate overall high cost, d) Unstable market demands and prices create significant risks for market oriented produce.

CONCLUSIONS

Recommendations for future strategies should be as follows: a) The Government at first sight should make an extensive international market survey, implicating the foreign marketing research agencies. European Community (EC) countries, Middle East and Near East, Russia and Turkic States could constitute potential markets, b) Growers will orient themselves to produce high quality crops whose postharvest handling will demand extreme care and involve modern concepts of postharvest treatment, processing storage and transportation, c) In Turkey usually apples, pears and table grapes are stored in cold stores. It should be cold stored in commonly different fruits and vegetables such as quince, peach, melon, cabbage, tomatoes, pepper, onion and potato etc. And store owners to modify their old stores into CA systems.

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