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THE STUDY OF POST-HARVEST LOSSES IN HORTICULTURAL CROPS IN ALBANIA WITH THE MAIN FOCUS ON APPLE

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Abstract

This Country Report describes briefly the work done and the activities carried out during the years 1995-1996 concerning the Research "Post- harvest losses in Horticultural crops in Albania" Initially, taking into consideration the level of the knowledge which was at the very beginning in Albania, the first step was preparing a general report, mainly based on the data that the Ministry of Agriculture and the other institutions possessed. The research presented has to do with studies carried out in three main directions. I. The identification of the physiological disorders and of pathological diseases which cause a lot of losses for apple-production in Albania. We determined Superficial Scald, Bitter Pit Chilling and Freezing Injuries, International Browning and various breakdowns. Apart from these there were identified some pathological diseases as *Monilia Rhizopus stolonifer, Bothrytis Cinerea, Penicillium* etc. The majority of these disorder and diseases are defined for the first time to fruits that are in storage in Albania. 2. The evaluation of losses in some fruits in Albania. This research was carried out in Wholesale and Retail Market in Korca, and it was looked over four main fruits that are widely used in Albania, such as apples, grapes, oranges and peaches. The main reasons of the damage were studied and the they were mechanic damages for the majority of the fruits was the main reason for the losses of the production. 3. The effects of the technology, concerning the "Storage Life of Apples" were studied as well. Being convinced that superficial scald is the main reason for these disorder for the apples, the research began to see the effect of it from the date of yield. It was resulted that the fruits that were gathered early, they were more predisposed to be touched by scald. At the same time, the main sorts of apples used in Albania such as Starking, Golden Delicious and Granny Smith are brought differently and have different susceptibility towards Bitter pit, Scald, Internal breakdown and infection diseases. We didn't find any correlation which was statistically acknowledged through the sensibility of the pruning and mineral nutrition, irrigation, etc., whereas the quality was improved within their optimal measures.

INTRODUCTION

Albania covers about 30.000 square kilometers and is located between parallels 39° and 42 ° in the North, and between 19 ° and 21 ° meridian in East. Albania is a Mediterranean country in Balkan Peninsula. About 40% of its border is coastline, the Adriatic and the Ionian Sea are situated in the West of the country.

The population (1995 census) is 3.4 million inhabitants, but actually might be less, because of massive emigration mainly in Greece, Italy, Germany etc. in the last 5 years.

Traditionally Albania has been a typical agricultural country, and still today more than 62, 50% of population is rural with their main activity on farming. There are about 400 000 family farms in a 700.000 ha arable land. The size of these farms are between 0.5-5 ha each. There is a law for land selling but its implementation is still not in use.

Three type of farms are distinguished: 10-12% of them produce for market, 35-40% produce for their own needs but occasionally they send something in the market, and 50% produce only for their own needs or are not in the position to fulfill their needs, and these happen in mountains regions and remote villages.

The main features of this period, 1991-1996, in Albanian agriculture are: heavy crisis in agricultural production and agro-food industries, privatization up to 96% of the land, processing industry and farming of the new system of wholesale and distribution based on private networks, loss of markets for agriculture products in the East countries etc.

The general evidence is as it follows:

Apples: Data for 1995 (all Albania)

	Total trees	Trees in production	Total production (ton)
Fruit trees	5 074 476	4 062 622	52 591
Apples	1 144 507	88 683	9 654
Pears	221 280	164 295	2 034
Peaches	118 776	80 304	1 012

Data for 1995 (Korca District)

Number of trees	Trees in production	Yield/tree (kg)	Total production (ton)
375.517	302 368	14	4 217

In Albania, as in some other countries, fruits and vegetables are most perishable commodities and often are only seasonably available. They are picked when nearly ripe and sold to consumers nearby. Here the losses are heavy, but accurate estimates are difficult to obtain.

As mentioned, while before 1990 some fruit and vegetable was exported, now Albania is becoming an importer of these goods from neighboring countries, particularly from Greece. This is due to the relative decrease of production, but also to the increase in fruit consumption. There are many factors which are difficult to be defined, but three are more prominent: change in life style, change of distribution networks and relative increase of consumers that can afford high prices.

The big issue for imported fruits and vegetables, is that some of them are not standardized, and with poor quality sometimes. A lot of delays take place in customs, and this aggravate the quality of fruits and vegetables which are transported sometimes in inappropriate trucks.

Field losses

Usually the picking of fruits and vegetables is done manually, which means that many inexperienced workers are involved. The great bulk of this fruits are used in

the family, and in the case of vegetables these usually are processed immediately or are undertaken various traditional methods of storage.

Small farmers do not own means of transport of their products. Therefore they rely on others, to provide means of transportation. This causes delays which means additional loss. The government is interfering in this business providing money through SME's, to buy vans and other means of transport.

There are no packaging in local markets, or they are use inappropriate boxes which increase losses also in this situation.

Transportation

The transportation of horticultural commodities from producer to the consumer is carried out by salesmen rather than producer. In many cases there are no contracts and the commodities are sold in the field. These salesmen usually sell immediately to retailers. No management of temperature, cooling or other parameters exist. Mixing of non-compatible goods in the vehicles and many delays in transport are very common. No refrigeration techniques are used in this chain.

Storage

Fruits and vegetables that are not used immediately are stored in cold rooms. Big cold rooms can be found in every city, but not in farms. These rooms which simply keep products cool are used for all kinds of commodities including animal production. Now they are in the process of privatization which is not easy because of their size and the lack of specialization. Some of these facilities are now out of date since their technology is going to be out of business. There are no parallel chains of cold rooms in retail or they are rarely used efficiently.

Recently we have seen improvement in all these stages in Albania particularly into the policy of agriculture development. Now the legislation intends to control production, protection and conservation techniques in order to offer the consumer good quality and nutritional value of fruits and vegetables.

Post-harvest diseases of fruit- trees and vegetables.

The most prevalent post-harvest organisms that cause decay in Albania are fungi for fruits and bacteria for vegetables. The most frequent fungi are *Monilia fructigena, Botrytis cinerea, Penicillium sp., Colletrotrichum gloespolroides, Mucor* sp. etc. From bacteria the most common group is the *Erwinia* group

The maturity of fruit at harvest is a critical factor in fruit life. As mentioned before, the majority of fruits are picked up when nearly ripe, which affects not only quality, but also makes them susceptible to pathogens during storage. Mechanical injuries and poorly pre- harvest hygiene greatly contribute to the decay of fruits and vegetables.

No post-harvest treatments were reported except pilot tests with Benzimidazoles. There is a border quarantine of imported and exported fruits and vegetables, but it is not everywhere well done and non-technical factors are involved, too.

Fruit and vegetables have a special place in people's nutrition in Albania. Fruit is becoming important part of daily diet, but still a limited number of them are in the market. Also the "boom" of animal production in the last 4-5 years was not accompanied with a balanced production of fruits and vegetables.

Albania has an excellent climatic condition for high quality of horticultural production such as tomatoes, grapes, apples, citrus, olives, cucumbers that can be exported if the potential is going to be realised.

A great obstacle for quality improvement are problems concerning handling, storage, packing and transportation. Albania has a Research Institute for Horticultural Crops and two Horticultural Departments at Universities. People there will able to work in this field if they are motivated to do that. They need a upgrading of knowledge and more information and this might be realised through a broader co-operation with other countries. On the other hand farmers, transporters, wholesalers, retailers are becoming aware of urgent need of this expertise. They need support and advice and it shows that something is moving for better. But on the other hand, training of farmers is necessary in order to improve pre-harvest and post- harvest situation. The first step is spreading of information and imposing of simple methods of post- harvest techniques.

Some of the farmers intend to produce for export and they need to know that empirical methods are not going to help them anymore, as the bad experience of exporting horticultural crops from Albania has proved due to the low quality of these commodities. Another case was the exportation of fruit and vegetables with pesticide residuals above permitted levels which resulted in returning them after detailed analysis in the western countries.

Consequently, farmers and local authorities must become aware that without reaching the required criteria in post-harvest techniques they will never have a good profit, even in local markets.

2. MATERIALS AND METHODS

Identification of Physiological Disorders and Pathological Diseases that Causes Losses to Apples

Apples (*Malus domestica Borkh*) are affected by several postharvest physiological and pathological disorders. Identification and knowledge of the disorders that occur during storage, shipping, or marketing is important as they can reduce quality and hence lead to substantial losses of fruit that require large inputs of labour, materials, and capital to be produced.

Methodology

The determination of physiological disorders and diseases was carried out in an commercial orchard, 15 km from Korca, at a place called Mollaj. Three cultivars are present there: Golden Delicious, Starking and Granny Smith. In 1995, 100 apples

from each cultivar were picked up separately and were packed in plastic boxes. The fruits were examined during 7-8 months storage in store and refrigerator. Apples were air stored at 0° C and after 21 days were removed to room temperatures and assessed for storage disorders.

Superficial Scald

Superficial Scald (hereafter referred to as scald) is a cold storage physiological disorder, which is found in apples removed from cold stores and in apples imported to Albania from neighboring countries. The disorder is characterized by brown patches that also appear on skin during storage.

The severity of scald is connected with the presence of oxidants in the skin of apples. But beyond that, maturity and harvest date greatly influence the development of scald during storage. It was observed that the disorder is more severe in the apples which are picked in an immature condition. Apples harvested in the end of September have developed more scald than apples harvested in October.

There are some other factors influencing the susceptibility of apples to scald, like cultivar susceptibility, pre-harvest temperatures, orchard location etc. which needs further studies to clarify.

Bitter Pit

This disorder increases with hot weather, water stress during growth, and early harvest. No calcium treatment was applied since this practice is unknown in Albania In several cases, the discoloured patches became sunken and rough and a variety of fungi were found which resulted in decay. No control measures are known and the disorder is not known even in text books. This was the first determination in this country.

Chilling and Freezing Injuries

In the chain of freezing rooms in all Albania this symptom is very common. The apples look glassy and have a wrinkled surface. If low temperatures were present for a relative long period, discoloration and water loss of the fruits were observed. In the next stage, the apples were soft, brown and smelled of fermentation. These apples are usually decayed in a couple of weeks. The cause of these disorders is that the fruits were exposed below their freezing point. The severity of the symptoms depends on the temperature, the time of exposure etc. Differences among the cultivars studied were not noticed.

Internal Browning

Internal browning is the symptom of various disorders, but the condition of storage is the main reason. This disorder is common, too, in Albania, especially at temperatures around 0° C. Late harvest, delayed storage and cool growing conditions aggravate the problem. Further studies are needed.

Senescence Breakdown

This disorder is found almost in all cultivars and is linked with prolonged storage of apples. It first appears as a brown discoloration of the flesh under the skin and later, the skin is affected, too. The fruit lacks flavor and taste. Overstorage increases the severity. At the very end the entire apple becomes mealy, and the soft area can be detected by touch.

Bruise breakdown

This disorder appears after mechanical damage of the fruit. There are brown and softened areas under bruise indentations. This type of breakdown is found in each cultivar but it is more common in Golden Delicious. There are not any studies about this subject in Albania. Generally, in literature all internal disorders are referred as "breakdown" and no specific data are available. The present study includes all disorders including breakdown problems, physiological disorders and pathological diseases in apples.

Determination of Post-Harvest Diseases in Fruits in Albania.

The post-harvest diseases are significant problems in Albania, and sometimes have a great impact on farmers' profit. As in other countries, the prevention of these diseases have been and still is a big challenge for the marketing of fruits. Post-harvest losses from parasitic diseases increase with the time between harvest and consumption. The delays are a result of lack of demand or of the distance between the production site and markets.

Methodology

During 1996 surveys in stores and market were carried out, in order to determine the major pathological causes in fruits. The samples of fruits, which show visible symptoms or were probably infected were collected and sent to the laboratory of the Faculty of Agriculture in the University of Korca. Microscopic determination was carried out according to standard methods.

The study was done in Korca Refrigerator No. 1, where apples were stored under normal refrigerated conditions (0-2° C). Samples of fruits were obtained, taking them at random of 22 apples from each cultivar.

The assessment of scald incidence was done in 80 apples removed from cold storage and left for a week at room temperature. There were some cultivars studied, but Golden Delicious and Starking predominated.

As regards phyto-pathological disorders, apples were taken from stores, shops and markets and examined in the Laboratory of the Agricultural Faculty in Korca. Known methods of diagnostics were used quite easily, because of experience in previous studies in recent years.

3. RESULTS AND DISCUSSION

The following diseases are determined and described for the first time in Albania:

Monilia sp which was found in plum and apple fruits, especially in young fruits with small wounds on the surface. These wounds were circle, brown and the spots were enlarged if the fruits were kept in proper conditions. We found the fungi in dead fruits of apples at the end of vegetative period. The detection of the pathogen was done in fruits immediately after harvesting, mainly in small wounds. The spores were found mature a week after harvest, after exposing in light. As species, *M. fructigena and M. laxa* were common.

Rhizopus stolonifer was found in some fruits. The impacted fruits were covered with a soft hyphae and we can detect sporanges on the surface of them.

Graymold *Bothrytis cinera* was found in grape of the variety "Perla" on fruits in storage. The infection was detected on other fruits that were stored in the same store, but the losses were not so heavy.

Penicillium sp was found on peaches and cherry. As species was *determined P. expansum* on the harvested fruits. This species was found on lemon, too. Also, at the end, *Gloesporium* sp. was determined.

The Evaluation of Losses in Some Fruits

Hand harvesting is a standard method for fresh market apples. No machines have been used for harvesting, unless in experimental stations just for experimental purposes. These hand-picked fruits have a lot of cuts and decay. Higher level of decay were found almost in all boxes of the experiment. Mechanical injuries occurred often during handling, transport and storage. As result, commodities decrease in value and increase their susceptibility to diseases and other disorders. For apples, these injuries were mainly friction and compression. In order to evaluate accurately the three main reasons of losses, apples were evaluated following to the below categories:

a. Apples without diseases or disorders.

b. Apples without mechanical damages or pathological diseases.

c. Apples without disorders or mechanical damages.

In every case losses were evaluated after having divided apples visually in every box.

The results obtained are shown in the following table. They represent the average of some measurements carried out during 1995-96 in the Korca Market.

Losses of some fruits on wholesale and retail level in Korca market (1995-96)

	Cause of losses			
	Mechanical damage (%)	Pathological diseases (%)	Other disorders (%)	Total
Apples	4.8	1.8	4.7	11.3
Grapes	9.6	1.9	3.6	15.1
Oranges*	2.2	6.3	2.8	11.3
Peaches*	10.1	6.7	0.5	17.3

* Imported

It was found that mechanical damage is the main reason for losses, except for oranges. For these losses, mainly poor handling, inappropriate packing etc. were responsible. The biggest losses could be observed for peach, with a percentage of 17.3%. Since these observations are made only at wholesale and retail chains level, the losses during harvest, in transportation and consumer will increase seriously the above numbers.

Common causes of post-harvest losses in fruits and vegetables in Albania

a. Field

I. Non- standard commodities due to unskilled picking workers. 2. Inadequate maturity (Immaturity or overmaturity). 3. Mechanical damage, during harvesting. 4. Delays after harvesting, due to transport which expose fruits and vegetables to destructive climatic factors.

b. Storage

I. Inadequate temperature and humidity control in stores. 2. Inappropriate packing 3. Lack of sanitation and preventive sprayings.

c. Transportation

I. Poor handling causing mechanical injuries. 2. In proper trucks and other means of transport. 3. Lack of refrigerated truck 4. Mixing of different commodities in transport vans. 5. Many delays during transport or at the customs.

d. Market (wholesale and retail)

I. Delays in sending the fruits to consumer 2. No refrigeration in local markets. 3. Exposure to destructive climatic condition in open markets. 4. Delays in marketing of perishable commodities.

Effects of pre-storage and storage technology on storage life of apples.

In apple orchards and plantations all around Albania one can not find any treatment to improve fruit quality and yield. Also, no growth regulators for improving fruit quality and extending storage life are in use in production. There are some attempts in new modern plantation to use different chemicals to extend the storage and marketing period of some fruits. The results of these trials are not appeared yet in scientific papers.

During different surveys it was found that certain growers were interested in using the appropriate technology for having apples that can have a long-term storage life. One of the methods advised was the use of moderate nitrogen fertilization, but not all farmers were content with that, due to a relative decrease of apple production.

Effect of harvest date on incidence of scald.

Ten Golden Delicious trees from a orchard near Korca were picked every 7 days, beginning from September 7 to the and of November (altogether 7 pickings). At

each harvesting, 5 kilos of apples were picked and put at 0° C. Progressively, they were removed from cold rooms and were assessed after two weeks for scald at ambient temperature. The table below shows the results obtained from one location. Scald evaluation was made in percentage of the surface area exhibiting scald. Mean percentage of damaged area is based on the fruit that developed scald.

The estimation of scald is base on the following scale:

1 = 0 < 1 < 15 of the surface affected

2 = 16 < 2 < 25 of the surface affected

3 = 26 < 3 < 35 of the surface affected

4 = 36 < 4 < 45 of the surface affected

5 = 46 < 5 < 60 of the surface affected

Scald injuries and scald scare

Picking	Scald %	Scald score
1	38	4
2	32	3
3	26	3
4	20	2
5	17	2
6	15	1
7	12	1

Results

The harvest dates have a great impact in the percentage of scald on apples. Scald was higher in the early dates of harvesting and was gradually decreased with the progress of harvest date. This disorder declined with the maturity of apples. As the table shows, harvest date is correlated with scald. Similar relationships between harvest-date and scald are reported for other cultivars in Peshkopi, Albania (personal communication).

Further studies are necessary in order to predict scald development from harvest date, and to connect these parameters with different temperatures and other environmental factors in various years. Also this should be connected with starch percentage and low temperatures that occur sometimes in November, which makes it impossible to postpone the date of harvest in apples.

Cultivars

Cultivars of apples behave differently in storage. Three cultivars were tested in one season. These cultivars were starking, Golden Delicious and Granny Smith. The test was performed in cool storage. The scale of susceptibility was measured in the following manner:

-Low (L), -Moderate (M), -High (H)

Susceptibility of three apple cultivars

	Starking	G. Delicious	G. Smith
Bitter pit	M	M	M
Scald	M	L	M
Internal Breakdown	H	M	L
Infectious diseases	M	H	H

A wide ranging in susceptibility was found among three cultivars concerning disorders, and infectious disease, which according to the table, was on top.

Mineral Nutrition

Potassium (K) nutrition influences post harvest fruit physiology. We have not only relevant evidence on impact of potassium nutrition on apples, but according to personal communication, an increase of potassium in a experimental plot increased the redness of Starking apples and have some influences on the decrease of apple decay. It seems that there is a big difference in comparison with control, but to prove that, further research is necessary. Based on this observation a survey was carried out on the impact of potassium on yield, fruit size and redness. For this purpose, an experiment was set up with for replications in order to evaluate the impact of K nutrition on the three above factors. No connection was found between nutrition and yield, fruit size and redness, but these characteristics were improved in plots without any K nutrition.

Irrigation

No influence of irrigation on storage life of apples was detected.

Storage Conditions

Storage life of apples is greatly influenced by temperature during storage. Generally, lower temperatures result in better storage, but chilling injury occurs in some cultivars. Controlled Atmospheres (CA) are not known in Albania. Refrigeration and the chain of cold rooms should be improved for native fruits and those that are imported from neighboring countries. Small refrigerators should be constructed and big ones should be put out of use.

Transportation

There are some modes of transportation used to move fruits in and out of Albania beginning from wheels, small cars and trucks. Refrigerated cars are in use and they are used mainly for import or long shipments. Still there are in use refrigerated cars that have been designed for transport of frozen vegetables and other food, but at the moment their primary destination is transporting of potatoes, onions, carrots, oranges and lemons. Due to limited demand in local markets we find two or three mixed commodities in a truck.

Marine transport is used rarely; and air transport is never used fir horticulture crops. According to the surveys, marketing

losses are evident during transportation because mixed loads and compromise temperature settings are not regulated according to scientific criteria.

4. CONCLUSIONS

The results obtained in this study are carried out during 1995-1996 and represent one of a few attempts to begin a large-scale research on this subject in Albania. The study of post-harvest losses is very eminent now, as a step towards various programs, in order to decrease the losses of perishable horticultural commodities in Albania.

Concerning the results obtained, it should be taken into account that these kinds of experiments are very difficult to perform, due to the transitional period of horticultural production in recent years. So, one can not expect to have very exact figures, especially on a long-term basis.

Thus, the following conclusions can be drawn:

During the study, the main physiological disorders and pathological diseases were determined in Albania. These include: Superficial Scald, Bitter Pit, Chilling and Freezing Injuries, Internal Browning, Senescent and Bruise Breakdown etc.

As pathological diseases were determined: *Monilia sp (M. fructigena, M. laxa) Rhizopus stolonifer, Bothrytis cinera, Penicillium sp* etc. Many of them are determined for the first time in Albania.

Losses of some fruits were evaluated for the wholesale and retail market including apples, grapes, oranges and peaches (period 1995-96). Mechanical damage is the main reason for losses, except for oranges. The losses for apples amount to 11. 3%, for grapes to 15.1%, for oranges to 11. 3% and for peaches to 17. 3%.

The effects of pre-storage and storage technology on storage life of apples was examined. It can be concluded that early harvesting of apples, as it is common in Korca Region, is a mistake because these apples are affected heavily from scald.

Also, a wide range of susceptibility was found among three cultivars studied. However, any relevant connection between storage life of apples and mineral nutrition, irrigation, etc. could not been detected, except relative quality improvement in some cases.

More research is needed to deepen those results and other subjects. And of course more attention must be given to the study of ways and methods for a satisfactory storage life of fruits and vegetables.