

# AGRI-FOOD SUPPLY CHAINS IN CROSS-BORDER TRADE OF NUTS AND DRIED FRUIT

PRE-EXPORT QUALITY, PRODUCTION AND  
MANAGEMENT:

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DRIED FIGS  
DRIED APRICOTS



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# CONTENT

- INTRODUCTION
- AGRI-CULTURAL PRODUCT QUALITY
- FACTOR AFFECTING DRIED FRUIT QUALITY
- MANAGING QUALITY IN DRIED FRUIT SECTOR
- CASE STUDIES FROM TURKEY
  - DRIED FIGS
  - DRIED APRICOTS
- CONCLUSION

# INTRODUCTION

- In the world market, the competition for agricultural products and value-added products is growing,
- Consumers want food to be affordable and of the highest value for the amount paid.

# INTRODUCTION

- The demand of the market is diversifying and multiplying
  - Increased communication tools,
  - Increased awareness for environment,
  - Increased concerns for social and ethical issues,
  - New challenges as the climate change,
  - Developments in technology (namely analytical procedures/GMOs),
  - New findings on health impacts.....



# WHAT IS QUALITY?

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Meeting consumer expectations

# What are the recent issues affecting nut and dried fruit sector?

- The production capacity in developed world is moving towards developing countries due to cheap labor and lower production cost,
- New challenges arise due to the distance between the grower and the consumer

# Recent picture in world markets

## Challenges

1. Quality standards,
2. Traceability,
3. Quality guarantee systems,
4. Certified products esp. in large retailers,
5. Local products/geographic indications

## Impact

1. Increased cost,
2. Complex documentation and more sophisticated systems,
3. Inspection and certification/increased cost,
4. Consumer awareness,
5. Short market channels

# Certification systems increase cost but ease access to the market

Private schemes (national/international)		Official schemes (national/international)	
<u><b>Labels</b></u> *Private company labels, *Regional	<u><b>Inspection of the chain and certified product/service/company</b></u> *GLOBALGAP, *BRC, *IFS, *LEAF, *Social standards	<u><b>Labels</b></u> *Marketing Standards,	<u><b>Inspection of the chain and certified product/service/company:</b></u> *Organic, *Geographic indications, *Good Agricultural Practices, *ISO standards, *Codex standards





# QUALITY BECOMES A 'WEAPON' IN MARKETING\*

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**\*'Faced with these new commercial challenges, the EU farmers' most potent weapon is 'quality'.**

Source: Brussels, 15.10.2008 COM(2008) 641 final GREEN PAPER on agricultural product quality: product standards, farming requirements and quality schemes

# Consumer expectations in the EU:

The most significant issues in the EU:

- Hygiene and food safety (a 'non-negotiable must'),
- Health and nutritional value,
- Societal demands (no child labour, working conditions..),
- Contribution made by farming on sustainability, climate change, food security and development, biodiversity, animal welfare, and water scarcity.
- Territorial development of regions, landscapes and valuable environmental areas,
- Taste, tradition and authenticity in their food,
- Higher animal welfare standards.

# Innovations and the consumers in the EU

«The main concerns for many consumers are hygiene and safety, and price.

For consumers seeking quality products with particular characteristics or resulting from particular farming methods, some of the main drivers of innovation include:

- a desire for consumers to reconnect with agriculture and give preference to local and seasonal products from farming systems that sustain both nature and society;
- the environmental concerns of combating climate change, managing natural resources such as water and soil more efficiently, and preserving biodiversity;
- promotion of nutritional qualities of foodstuffs;
- societal concerns: the Fair Trade label is an example of a scheme based on the strategic intention to help producers and workers (chiefly in developing countries) move from a position of economic and social vulnerability to one of security and economic self-sufficiency;
- animal welfare: private schemes promoted by animal welfare groups and farmers working with retailers and the scientific community».

**DRIED FRUIT SECTOR:** Dried fruit are as susceptible as fresh to pre-drying conditions



## FACTORS AFFECTING DRIED FRUIT QUALITY

- Variety,
- Growing conditions,
- Cultural practices,
- Harvest maturity and method,
- Post-harvest handling and conditions



## Variety: Major properties

1. High adaptability to diverse conditions (climate, soil, ...),
2. High yielding,
3. Resistant to biotic and abiotic stress conditions,
4. Provide homogenous ripening,
5. Resistant to transportation and bruising,
6. High quality scores esp. for appearance, texture, taste, flavour, nutritional properties (high dry matter is preferred in drying)
7. Low harvest and post-harvest losses,

# Growing conditions

1. Altitude: Low land or upland,
2. Soil depth, texture and fertility,
3. Temperatures during fruit maturation and ripening period,
4. Relative humidity during fruit maturation and ripening period,
5. Adverse climatic conditions (rain, hail, excessively high temperatures...),

# Cultural practices

1. Rootstocks,
2. Pruning,
3. Fertilization,
4. Pest, disease and weed management,
5. Soil tillage,
6. Irrigation....



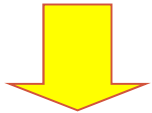
# Harvest

- ❑ Fruit is harvested at full maturity,
- ❑ Harvest can be done manually or by mechanical harvesting,
- ❑ Pre-treatments help to fasten drying and improve dried fruit quality,

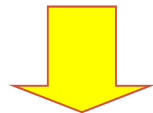


# The initial raw material quality is the main determinant

75 %



80 %



80 %



65-70 %



# Sun-drying

## Disadvantages

- Drying is slow and the drying period varies,
- Moisture content is decreased upto an equilibrium level,
- Difficult to maintain hygienic conditions at the farm,
- In case of adverse climatic conditions higher losses may occur,
- Special area is required

## Advantages

- Energy efficient (renewable, low),
- Colour differences disappear under sun,
- Drying reduces volume, ease transportation and storage,
- Extend shelf life and marketing,
- Added value at farm level,

# Water activity ( $a_w$ )

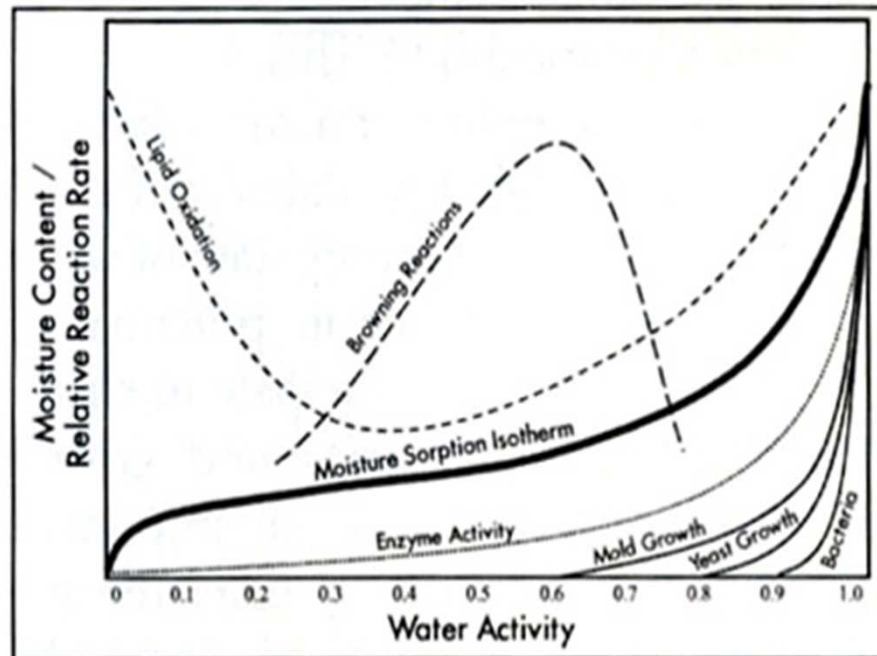


Figure 1. Water activity stability map.  
(Adapted from Labuza).<sup>8</sup>

- **Water activity** is defined as the ratio of the vapor pressure of water in a material ( $p$ ) to the vapor pressure of pure water ( $p_0$ ) at the same temperature.
- The main factor affecting chemical, biochemical and microbial changes



## Water activity ( $a_w$ ) and quality loss

- The moisture content of sun-dried (intermediate moisture) fruit is  $\leq 0.7$
- These values range between 18-25 % but differ according to the product and temperature
- Microbial growth:
  - Bacteria:  $a_w < 0.90$
  - Some halophytic bacteria:  $a_w < 0.75$
  - Yeast:  $a_w < 0.80$
  - Mould:  $a_w < 0.70$
  - Safe  $a_w < 0.65$

## Water activity ( $a_w$ ) and quality loss

- At lower ( $a_w < 0.85$ ), enzymatic changes (amylase, peroxidase and phenoloxidase) are limited,
- Lypase can be active up to  $a_w=0.25-0.30$ ,
- Non-enzymatic browning (Maillard reactions) is closely related to  $a_w$ .
- Chlorophyll degradation slows down under  $a_w < 0.7$ .

## Quality classification

- ❑ Damaged, unripe, over ripe fruit, foreign material, stem pieces are removed,
- ❑ To remove dust or chemical residues products are washed for a short periods,
- ❑ Fruit are sized or the largest and smallest are removed,



# Pre-treatments: to ease drying and improve quality

## Alternatives

- Sulphur treatments (gas, dipping)
- Alkaline treatments (NaOH, Na<sub>2</sub>CO<sub>3</sub>, K<sub>2</sub>CO<sub>3</sub>),
- Other solutions
  - Ascorbic acid, citric acid, malic acid solutions,
  - Antioxidants as tocopherols, sistein,
  - Sorbic acid or its salts as an antimicrobial agent

## Limitations

- Variable MRLs for SO<sub>2</sub>
- Sulphur, NaOH and sorbaic acid and its salts treatments not allowed in organic management,
- Alkaline treatments: Optimum concentration and duration must be determined for each variety,
- Organic allows potassium carbonate and citric acid, ascorbic acid and natural antioxidants



## Transportation from farm to processing plant

- Boxes must be used instead of bags to preserve quality,
- Vehicles and boxes used must be clean,
- Secondary infestation or any chemical contamination must be prevented



# Storage pests



# Controlling storage pests

- ❑ Methylbromide (banned due to ozone layer depletion effect)
- ❑ Phosphine ( $\text{Mg PH}_3$ )
- ❑  $\text{CO}_2$  application under high pressure (20-30 bar)
- ❑  $\text{CO}_2$  application under atmospheric pressure,
- ❑ Deep-freezing,
- ❑ Other alternatives:  $\text{ECO}_2$ , ECOFUME, Microwave...

# Storage

Storage period depends on;

- Pre-treatments,
- Storage conditions (temperature and RH),
- Moisture content of the product,
- Physical and chemical composition of the product.

## Storage at ambient conditions

- ❑ The storage rooms must receive aeration,
- ❑ All openings must be closed/netted to prevent secondary infestation,
- ❑ Microbial growth, rodents and all pests must be controlled,
- ❑ Storage rooms must be separated for the raw material, final product and other materials (boxes, packaging material etc.),
- ❑ Storage rooms must be cleaned, repaired and white washed or disinfected prior to every season,



# Storage



# Ideal storage conditions

0-4°C and %60-65 relative humidity





# HOW TO MANAGE?

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# Important steps

- Analyze the market demand,
- Quality/Price,
- Availability and quality of the raw material,
- Ecology of the growing regions, yearly fluctuations,
- Cultural practices applied, risks associated,
- Harvest period and optimum harvest maturity,
- Pre-treatments,
- Processing/packaging capacity,
- Availability and capacity of the labor force,
- Value chain management,
- Traceability,
- Additional quality schemes,
- Prepare business plan for the selected crop(s).....



**MAJOR HAZARDS VARY  
ACCORDING TO THE PRODUCT  
AND/OR PRODUCTION  
CONDITIONS**



➤ **Chemical risks**

- Aflatoksin
- Ochratoksin A
- Fumonisin B1 and B2

➤ **Physical risks**

- Leaf, stem pieces,
- Wood pieces, plastics

➤ **Biological risks**

- Water quality
- Mites,
- Microbial load

➤ **Chemical risks**

- Sulphur dioxide
- Pesticides residues

➤ **Physical risks**

- Stem pieces, pedicels,
- Inorganic foreign material: stone pieces ..

➤ **Biological risks**

- Microbial load
- Fermentation esp. for untreated ones
- Mites