



UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

DRIED FIGS

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OUTLINE

- Introduction
- Fig Production in Turkey
 - Fig growing
 - Caprification
 - Harvest
 - Drying
- Defects
- Post-harvest handling and storage
- Processing
- Conclusion

FIG CULTURE

- One of the first domesticated fruit,
- *Ficus carica* L.; **carica** comes from the region in western Turkey, **caria**,
- Sun-drying has been a tradition in the Middle east and Mediterranean since millenia,

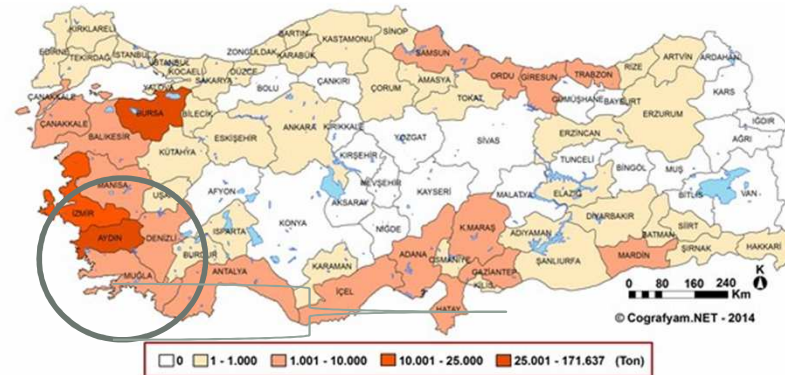


Fig producing regions

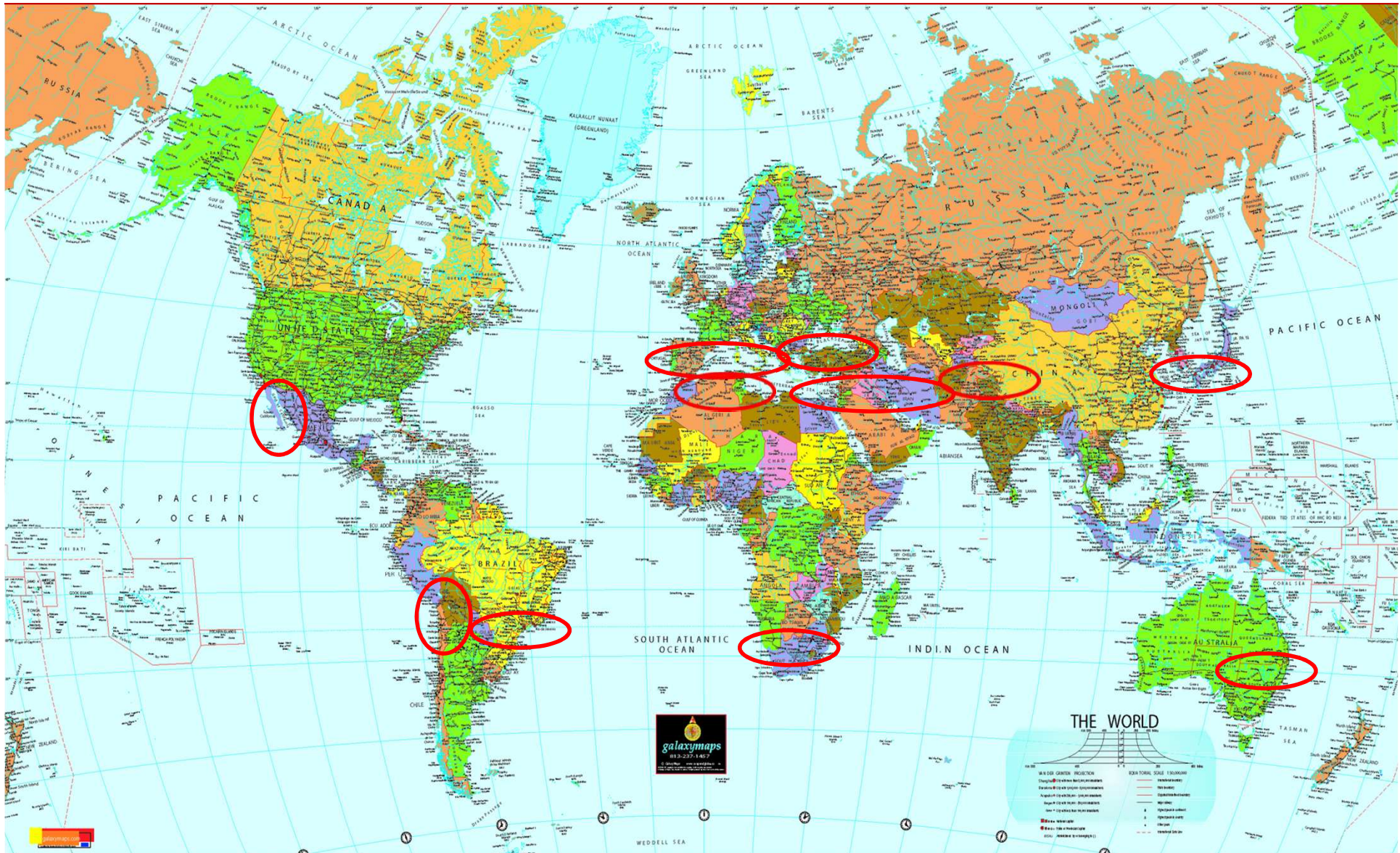
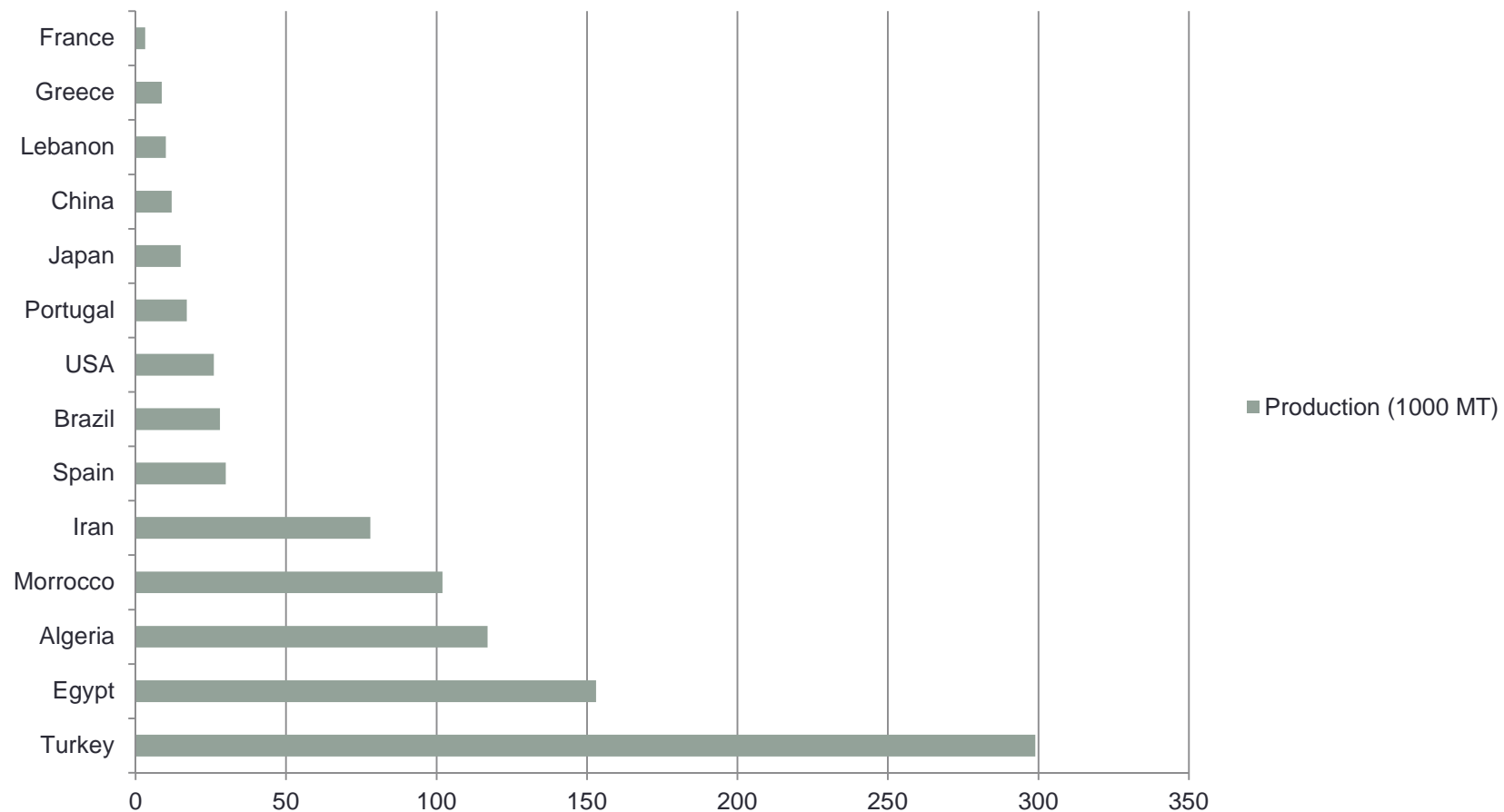


Fig Production (2013)

WORLD TOTAL= 1 117 452 MT on 358 493 ha

(www.faostat3.fao.org)

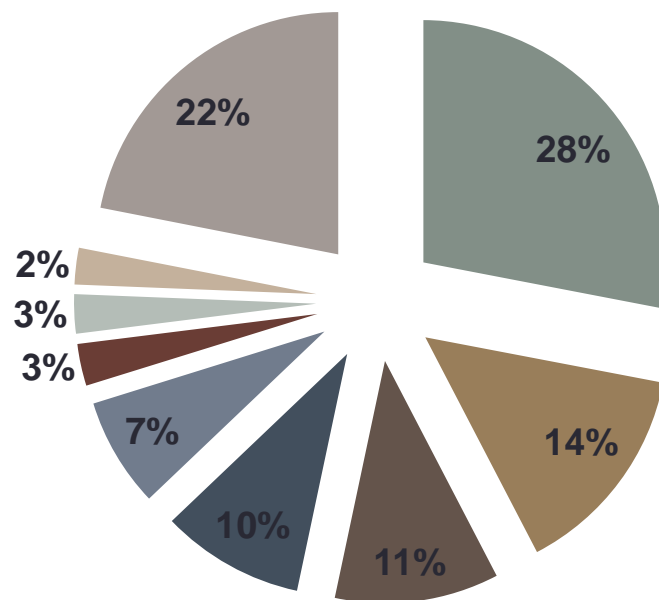
Production (1000 MT)



World fig production (2013)

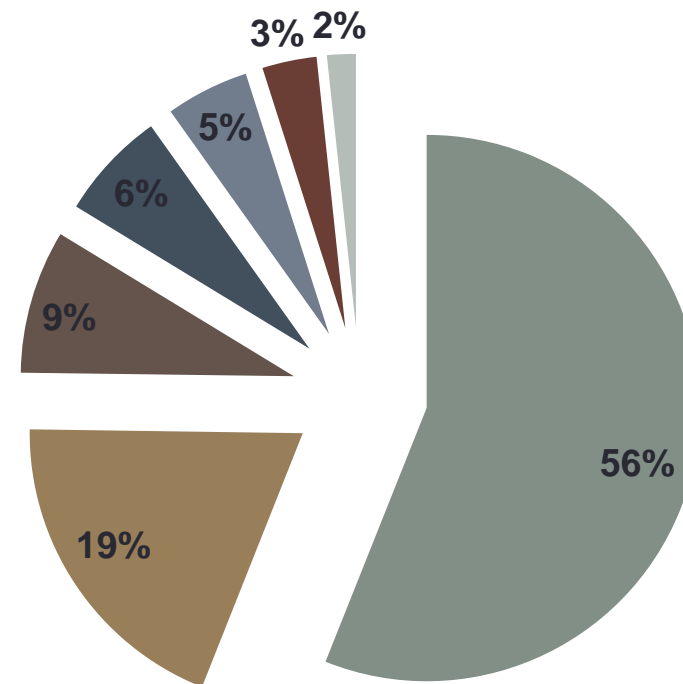
World fig production (fresh basis)

Turkey Egypt Algeria Morocco Iran
Spain Brazil USA Others



World dried fig production (2013/14)

Turkey Iran US Greece Spain Italy Others

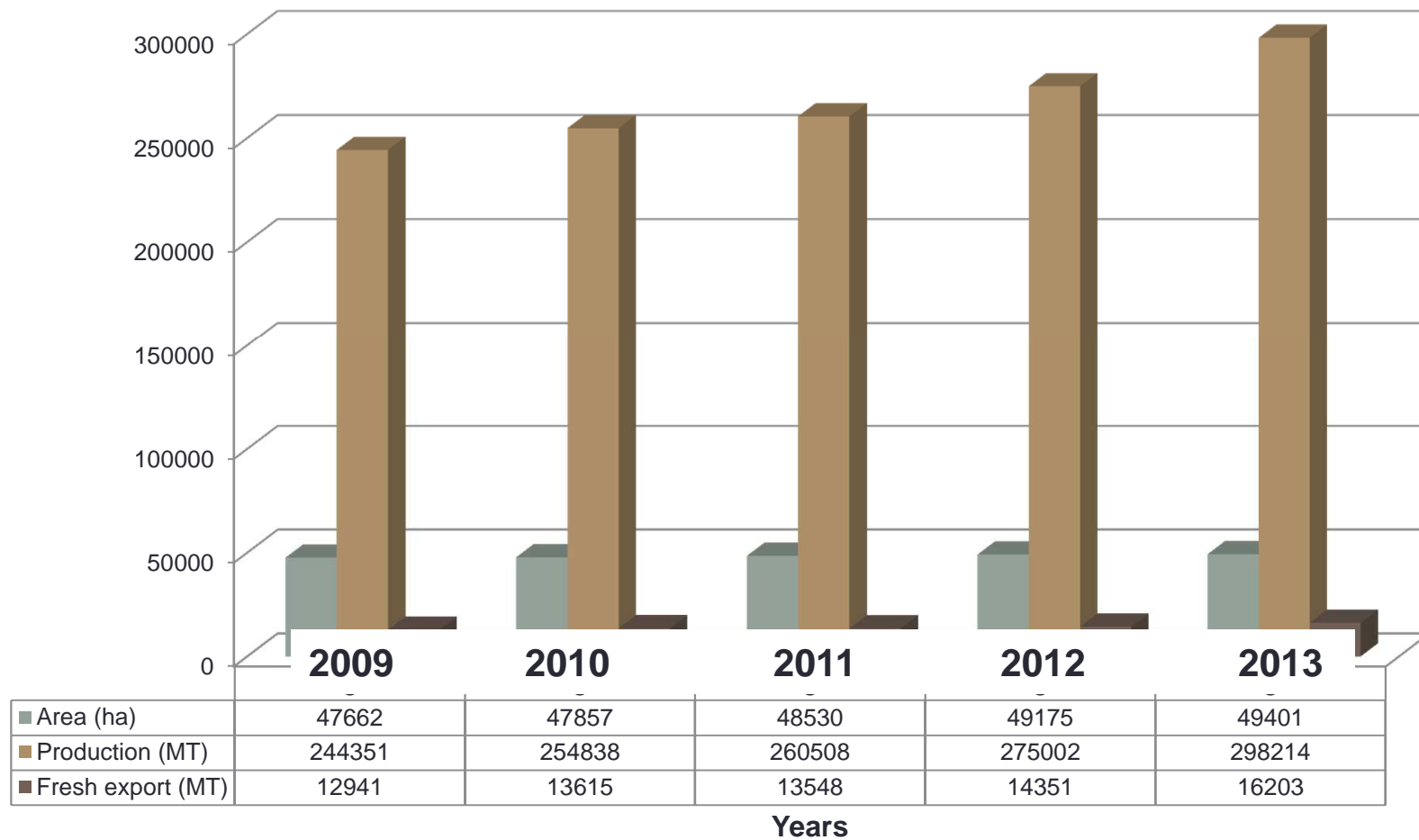


Source: Faostat and INC

Fig production in Turkey



Fig Production in Turkey (2009-2013)



Source: Dumanoglu et al., 2015

Fig growing



Upland and lowland fig orchards



Main features of fig growing

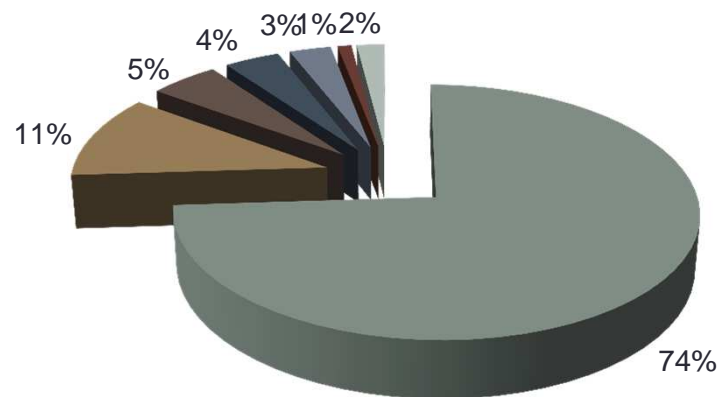
- All propagated by cuttings (no grafting),
- Extensive, 5x5 to 10 x 10 m distances between and on rows according to the fertility of soil,
- Generally rain-fed,
- Low-input (low levels of pesticide and fertilizer use) management,
- Main varieties are: Bursa Black (fresh) and Sarılop (=Calimyrna) (sun-drying),
- Both varieties need caprification for fruit set,
- Figs exported as dried, fresh or processed

Uses

- **Leaves:** Aromatic compounds for cosmetic industry; medicinal use; animal feed,
- **Male fruit:** Caprification of female; jam,
- **Fresh Fruit:** Table consumption; Processing (jam, marmalade),
- **Dried Fruit**
 - Whole figs: Snack, home baking, cooking,
 - Softened: snack, desert,
 - Chopped: muesli, breakfast, cereals, fruit bars,
 - Clipped: jam, marmalade,
 - Paste: biscuits, cakes,
 - Low grade: industrial use (alcohol); animal feed

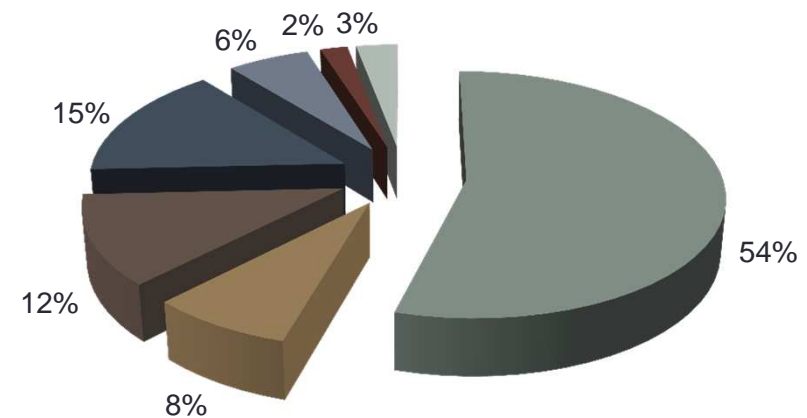
Turkish dried fig exports by regions*

2007



■ EU member states ■ Non-Eu (CEE)
 ■ Americas ■ Ocenia & Asia
 ■ Middle east ■ Africa
 ■ Free zones

2013



■ EU member states ■ Non-EU (CEE)
 ■ Americas ■ Ocenia & Asia
 ■ Middle east ■ Africa
 ■ Free zones

*Source: Pagy, INC Annual Conference 2015



QUALITY AND SAFETY
ARE IMPORTANT !!

Fig varieties and quality

- Fig varieties are diverse:
 - Pollination requirement for fruit set and maturation
 - Fruit setting: Spring (breba), summer (main crop) and autumn crops,
 - Ripening period: Early, mid and late
 - Length of the harvest period: Short, intermediate, long
- **Selection of the right variety is important,**
- For drying:
 - High soluble solids content (high sugar, pectin, low acidity) allow fast drying and high quality dried fruit,
 - Short intervals between each consecutive fruit,

Sarılop Dried Figs



- Sarılop (=Calimyrna) main variety for commercial drying in Turkey,
- Production is ca 210 000 MT
- Main crop is the summer crop, requires pollination for fruit set,
- Fruits form and mature (*beginning of August to mid October*) on the current season's shoot,
- High sugar and low acid content, suitable for drying Susceptible skin, easily bruised, so not suitable for fresh consumption,
- Ca 30 % certified as organic,
- Exported as deep-frozen,
- *Fruit quality is largely affected by the climatic conditions prevailing during fruit development, maturation and drying period.*

Fig fruit formation



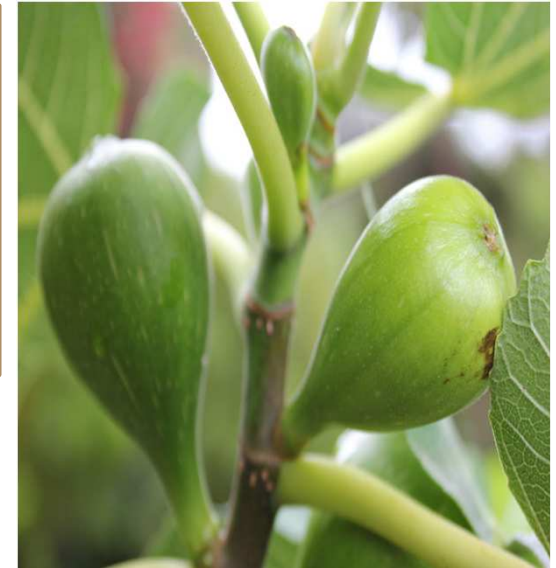
Main crop on current year's shoot

Breba crop on previous year's shoot



Breba crop on previous year's shoot

Main crop fruit formed in the leaf axils at intervals



Ficus carica is a gynodioecious species, the male (hermaphrodite fruit) and the female (female fruit) trees are separate.

- Caprifigs: Male fruit formed on male trees; produces 2-3 crops per year as profichi, mamma and mammoni. Profichi is used to pollinate the main crop

Male figs host many fungal diseases e.g. *Fusarium* spp., *Aspergillus* spp. So clean male figs must be used in caprification



The female fig varieties are classified under 3 groups in respect to their fruit bearing and setting requirements:

- i) **Common type:** One or two crops per year; fruit are born on both previous (breba crop) and/or current year's (summer or main crop) shoots, both fig crops do not require pollination for setting and ripening and are named as '**persistent type**',
- ii) **Smyrna type:** Fruit are mainly born on the current years' shoots and require pollination for fruit set and further maturation (**non-persistent or cauducous**),
- iii) **San-Pedro type:** the breba fruit on previous years' shoots do not require pollination (**persistent**) however the summer crop formed on the current shoots develop and mature only if pollinated (**cauducous**).

CAPRIFICATION

hanging male fruit to release fig wasps that carry pollen to the female fruit

- Some fig varieties must be pollinated for setting fruit and further development,
- When female fruit reach to 2.0-2.5 cm diameter, male fruit are hung onto female trees 2 or 3 times at 5-7 days intervals (**caprification**),
- Caprification occurs between June 10-July 10 in Turkey according to the varieties and locations,
- Caprifigs host fungal diseases therefore healthy caprifigs must be selected for hanging,
- After pollination male figs are collected and destroyed outside the orchard.



Female fig wasps on male fig fruit



Female fruit ready for caprification (above) male fruits hung onto the female tree (below)



MALE FRUIT: Pollen source and raw material for jam and confectionery (collected before fig wasp enters)



Factors affecting quality in dried figs

- ❖ Variety,
- ❖ Climatic conditions prevailing during fruit maturity and drying,
- ❖ Cultural practices,
- ❖ Harvest time and method,
- ❖ Post-harvest conditions and treatments,
- ❖ Storage, processing, packaging, transportation,
- ❖ Retail conditions



Harvest

- Fig fruit development is double sigmoid
 - Phase I: Rapid
 - Phase II: Slow
 - Phase III: Rapid
 - During Phase III, 70 % of dry weight and 90 % of sugar accumulates,
 - Fruit size increases drastically,
 - Pigment changes occur (chlorophyll content decreases while surface colors e.g. dark pigments in purple cultivars develop) and texture softens.
 - The length of Phase III varies among fig cultivars. It ranges between very short (10-15 days) as in Sarılop or very long (6-8 weeks) as in Israeli variety Autumn Honey.
 - For drying, mature fig fruit are left on the tree, lose water, shrivel and fall onto the ground (fruit moisture content ranges between 30 and 50 %).
 - HARVEST FOR SUN-DRYING IS DONE BY COLLECTING FROM THE GROUND.

Care at Harvest

- Fig fruit should be harvested at relatively cooler times of the day (early morning) before the fruit temperature starts to increase,
- All the equipment used for harvesting figs must be clean and free of any dust or chemicals,
- The picking baskets should not damage the fruit,
- It is recommended to use 15 kg boxes
- Hygiene should be maintained at the orchard and at all facilities.



Harvest

Partially dried figs should be picked from the ground twice a day/everyday to prevent mould and pest damage



DRYING YARD (AREA)

- It s better to arrange a specific area for further drying,
- The drying area where the trays will be placed should be:
 - Away from any source of contamination (e.g. Animals, toilets, dust),
 - Under direct sun, avoid shade or between rows,

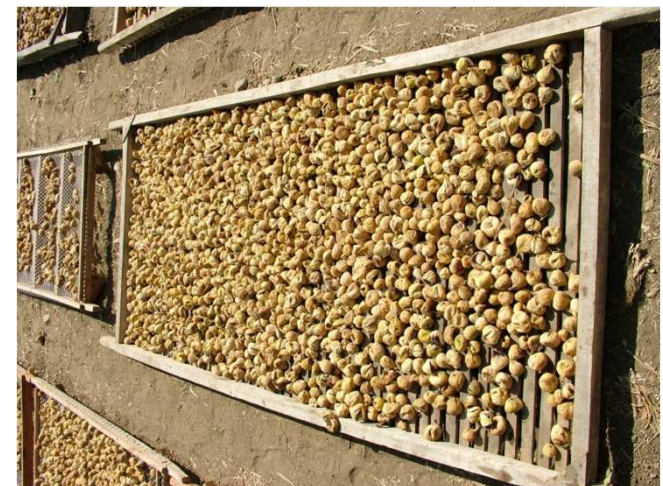


Major dried fig pests are lepidopterous moth so they are attracted by light,
Never turn on the lights at night in the drying yard or in the storage rooms that are exposed to external pest infestation



DRYING TRAYS

- The frames could be plastic or wooden,
- The trays
 - The size (capacity) and shape should allow to be carried easily,
 - The width (two-arms length) must be convenient to reach to the center,
 - The surface should prevent any bruising or mechanical damage,
 - Should have **short legs** to prevent direct contact with soil (foreign matter risk) but still utilize soil heat,
 - Could be put on top of each other and closed in case of rain



Sun-Drying

- Partially dried figs are spread on trays for further drying,
- Fruits should not contact directly with the ground,
- Only fully dried figs (<24 % moisture) must be removed.
- Fully dried figs must be removed from the trays preferably in the cooler period of the day.



On-farm storage

- Never place directly on soil,
- Cull (low quality) figs should be kept separately in an isolated place to prevent cross contamination,
- Other fruit can be a source especially for dried fruit beetle and vinegar flies



Seperating healthy from low quality fruit



- When collecting from the ground or taking the fully dried ones from the drying trays or at any relevant stage, cull (unfit for consumption) should be removed from healthy crops.

In case of rain or high humidity, tummels can be used to accelerate drying



DRYING: To preserve quality dried fruit should be kept in boxes rather than bags



DEFECTS

MECHANICAL DAMAGE/SKIN DEFECTS

- Fig fruit skin is sensitive to bruises,
- Hail prior to harvest,
- Harsh winds,
- Friction of leaves or shoots because of harsh winds
- Insect damage



Too many fruit per shoot due to overcaprifigation

Risk:

Smaller fruit size

Side cracks

Skin defects due to friction

Malformation:

Two internodes
form the fruit
instead of one



If pollination is not adequate then fruit shape can be assymetrical



OSTIOLE-END CRACKS (SPLIT)

Low resistance of the skin against rising internal pressure

Why?

Rain just before or during harvest time,

Skin elasticity (varietal characteristic),

Excess nitrogen fertilization, high K/Ca ratios (low fruit Ca levels)

Excess irrigation or improper irrigation scheduling



Sunscauld (Sunburn)

- Yellow varieties are more sensitive, and defect is more apparent,
- Severity varies, may cover the whole fruit.
- Why?
 - Excess temperatures and heat waves,
 - Wrong pruning especially during the first years after planting,
 - High fruit Ca levels.



INTERNAL ROT

- Occur as browning in the internal cavity at the initial stage, then the pulp softens, ferments, flavor changes, pink exudate flows out of the fruit
- **Why?**
- Mainly as a result of *Fusarium* transferred from the male fruit during caprification



Surface rot (decay) at harvest

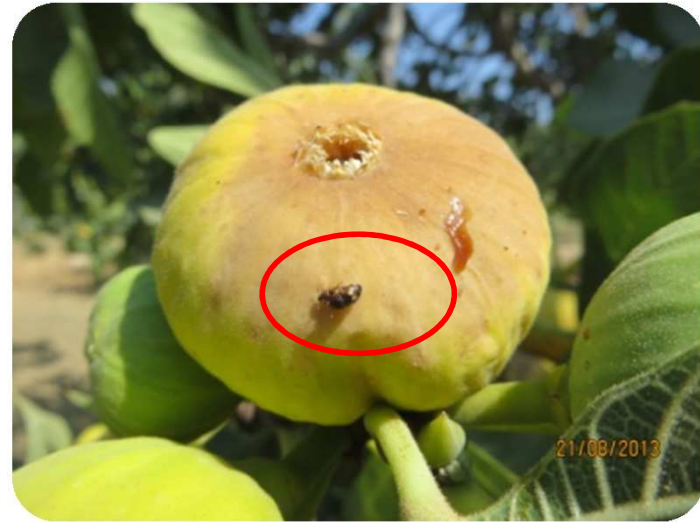


Pests

DRIED FRUIT BEETLE (*Carpophilus* spp.)



Controlled through bait traps



Attacks mainly rotting fruit,
however found to infest sound
fruit,
A vector of fruit internal rot
and other fungal species

Storage pests attack fig fruit

FIG MOTH

(*Ephestia cautella*; *Plodia interpunctella*)



Infest after fully ripe stage and continue during and after drying and in storage

NO CHEMICAL CONTROL MEASURES FOR THESE PESTS

Cultural practices for prevention:

- *Frequent harvest,
- *Remove any plant material debris in the orchard,
- *Do not turn on lights in drying yards or storage rooms,
- *Prevent infestation in storage,
- *Use allowed methods of fumigation to prevent further infestation.

Pests

Wax scale: *CEROPLASTES RUSCI*

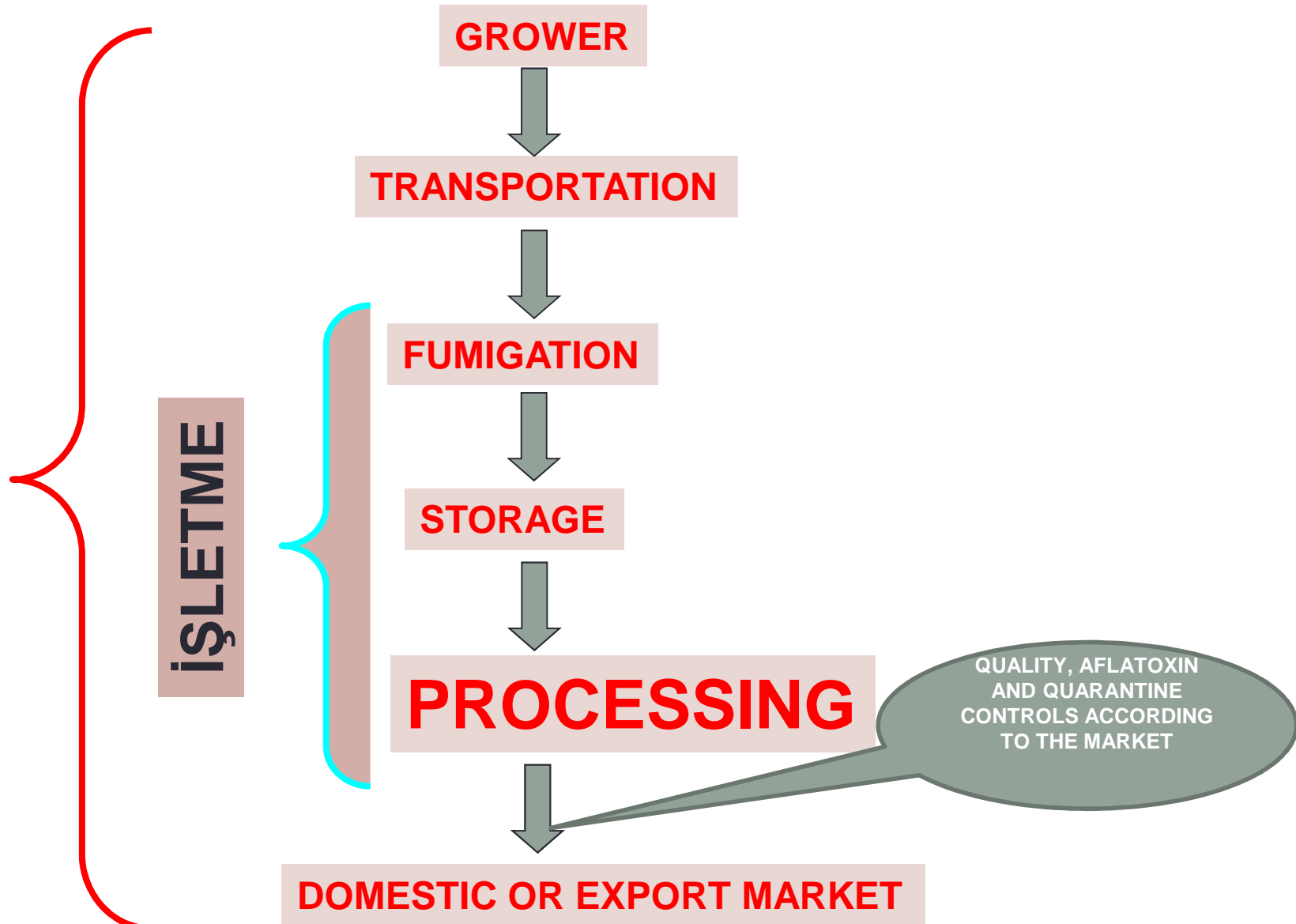
- Significant only at certain locations,
- Population reduced by very low or high temperatures,
- Scales attack the leaves first but may pass onto the shoots and lastly to the fruit,
- Two generations: around caprification and towards the end of harvest,



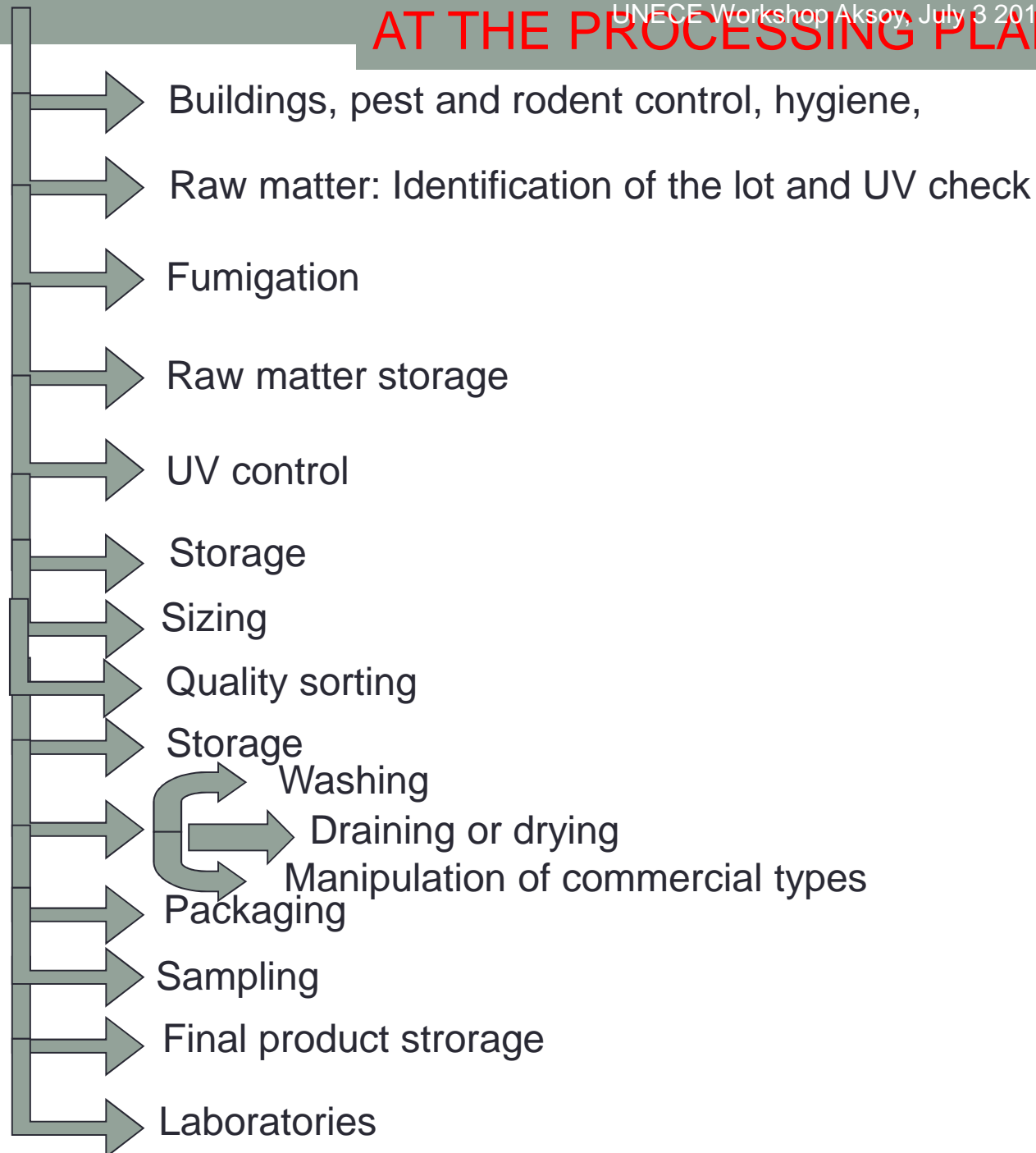
PROCESSING

DRIED FIG PROCESSING FLOW CHART

RECORD KEEPING AND TRACEABILITY



AT THE PROCESSING PLANTS



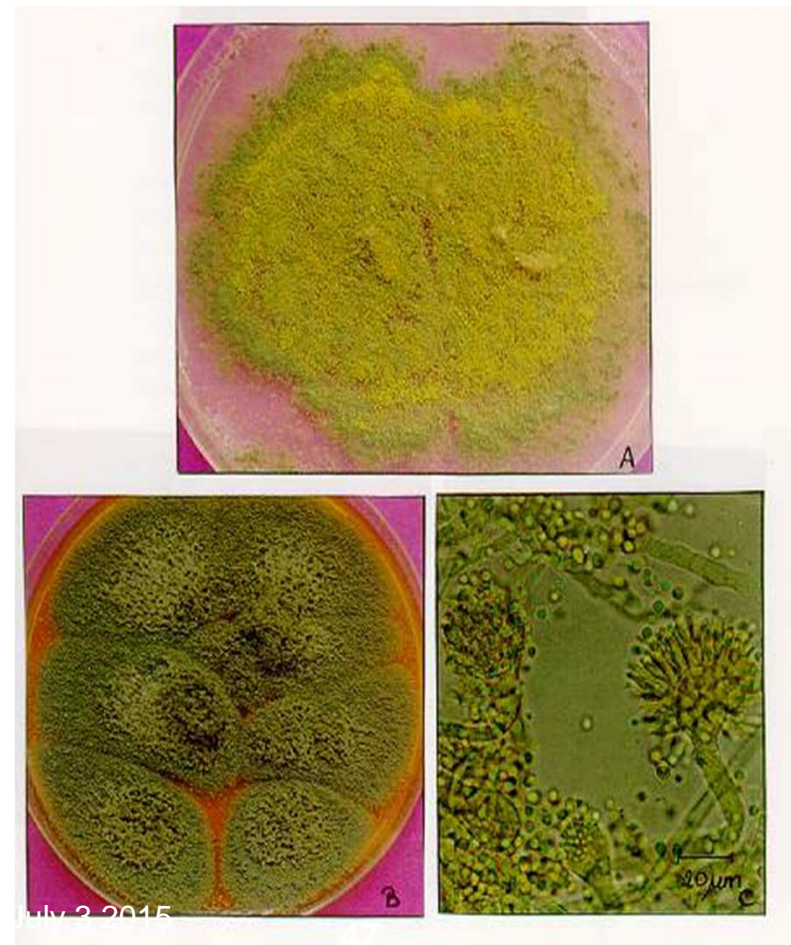
BAD PRACTICES



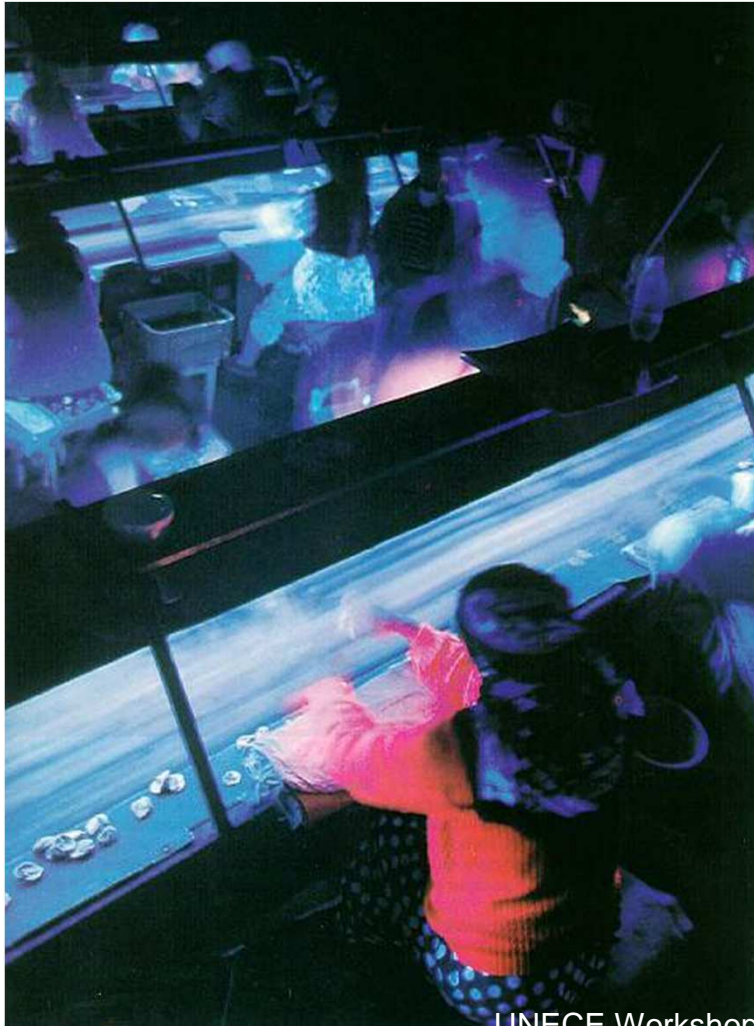
Aflatoxins: toxigenic secondary metabolites of *Aspergillus flavus*,
A. parasiticus and others...

A. flavus

- The critical period for aflatoxin formation in figs is the period between maturity when the fruits are on the tree until they are fully dried
- Many factors may trigger aflatoxin formation: cooler & humid conditions during drying, drought, substrate composition (pH, mineral nutrients, phytoalexins, carbohydrates), vector insects



Aflatoxins in dried figs



- Dried figs are screened under UV light to remove the contaminated fluorescent ones
- This process is done in every processing-packing unit









Storage

- Dried figs can be stored under ambient conditions if the relative humidity does not exceed 65%,
- Recommended storage conditions are:
0-4 °C and 65 % RH
- Under these conditions dried figs can be stored for more than 12 months.

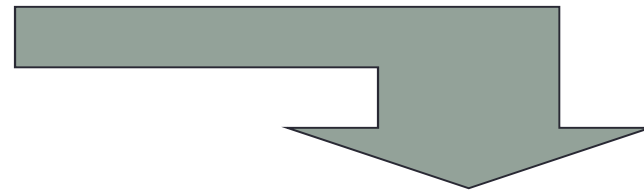


Effect of storage on quality changes

10. Months of storage
Ambient **Cold**



Sugaring



Storage pests and fumigation



Chemical control in processing plants:

Methyl Bromide: Unique fumigant banned due to ozone layer depletion,

Phosphine: Al and Mg phosphide Pellet, pack and gas forms

ECOFUME: Phosphine + 2 % CO_2



Fumigation chambers and alternatives: High pressure, atmospheric pressure, cocoons, gas tight chambers



Organic produce

Carbondioxide application: High pressure or atmospheric pressure

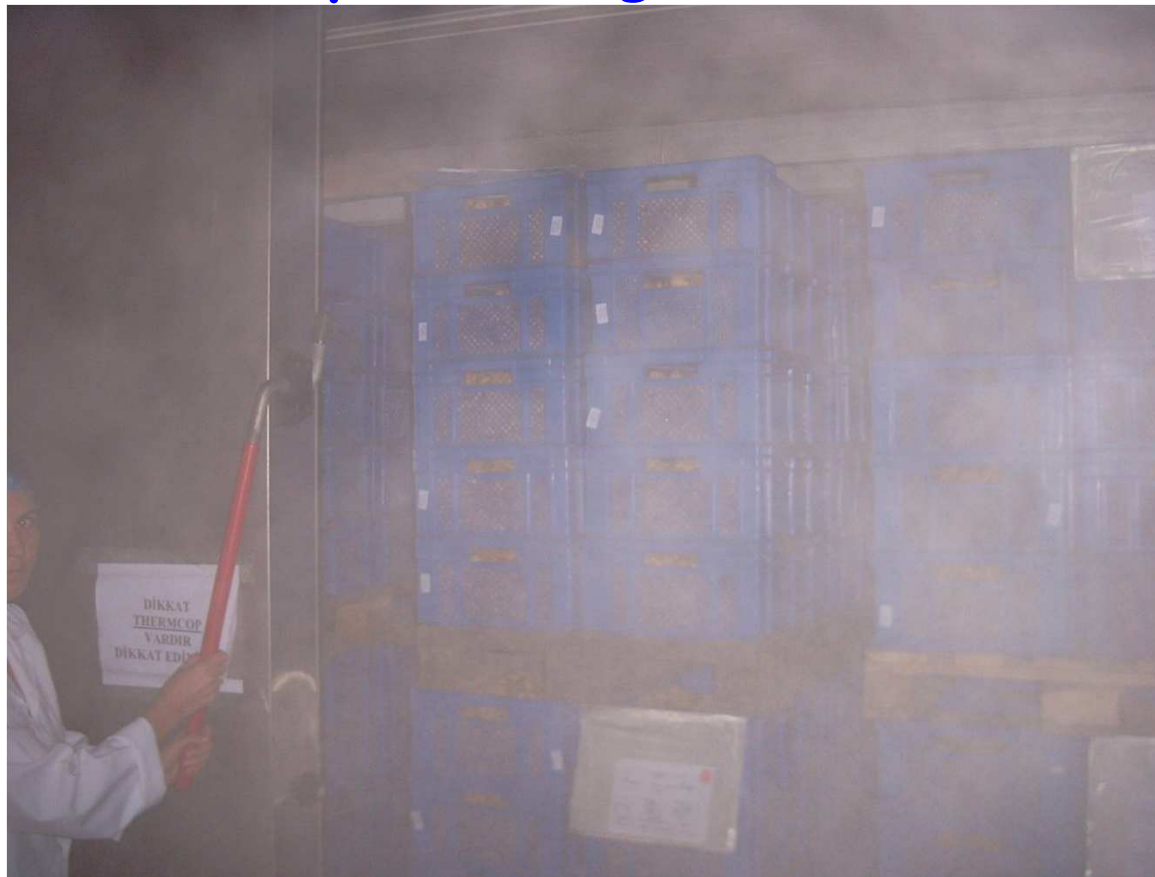


Carbondioxide application under atmospheric conditions



Organic produce

Deep-freezing

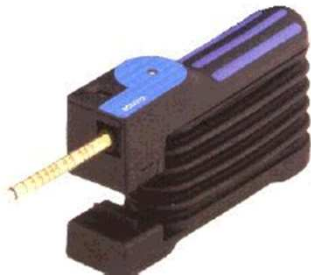


-25°C 24 hours

**The temperature
and its duration
at the core is
important**

Safety in fumigation

- Gas concentrations,
- Personal safety,
- Maintenance of the equipment.



Good Agricultural Practices and Organic Certified Products

- In Turkey, organic agriculture is regulated since 1994,
- Current legislation is almost identical to the EU,
- Inspection and certification is done by accredited independent control bodies authorized by the Ministry of Food Agriculture and Livestock,
- Government subsidizes GAP and organic to increase high quality production in Turkey,
- In Bursa organic certified area including in conversion (2013) is 27.9 ha and the production is 1270 MT (www.tarim.gov.tr).
- In Aydın and İzmir provinces, organic certified area including in conversion is 56 310 ha producing 17 771 MT of dried figs. Conversion rate is high (www.tarim.gov.tr).
- GLOBALGAP and GAP certifications are more popular for the fresh export market.

Conclusion

- High in nutritive and health aspects of the fig fruit are known for millenia. The first reports on its health properties date back to 2900 BC during semitic Akkadian empire,
- Today, paralel to the demand for healthy snacks, dried fig marketing is still enlarging,
- Different varieties can be sun-dried either for direct consumption or for further processing,
- Market quality standards as well as quality assurance systems must be adopted by the sector in order to provide the quality demanded by the consumers.

V International ISHS Symposium on Fig

August 31-Sept. 3, 2015

Location: Napoli (Italy)

Hashtag [#fig2015](#)

Deadline abstract submission: May 15, 2015

Conveners:

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[ISHS Section Nuts and Mediterranean Climate Fruits](#)

[Workgroup Figs](#)



ISHS

International Society for Horticultural Science

Abstracts of the papers presented in previous fig symposia can be downloaded from:

www.actahorticulturae.org

Free of charge.