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Curse of Postharvest Physiology and Pathology

3 hours lectures per day on postharvest physiology on the morning

3 hours lectures in the afternoon of postharvest pathology

2 hours examination at the end on next Friday 22 of July



Subject of study in Postharvest Physiology

1. Introduction to maintaining quality fresh produce after harvest
2. Quality and maturation - physiological and biological aspects
3. Respiration, ethylene production, physiological and biochemical aspects
4. Cooling, cooling methods and the importance of cooling – principles and applications
5. Modified and controlled atmosphere – principles and applications
6. Waxing and packing
7. Treatment of fresh produce after harvesting

1st Lecture: Physiology

Postharvest Physiology

Introduction

Materials to this presentation Prof. Eli Fallik
Dr. Noam Alkan
Prof. Ron Porat

Definition: Postharvest Physiology of Fruit and Vegetables

The changes that occurs to the commodity from the time of harvest, through storage and shipment of the intact or sliced produce

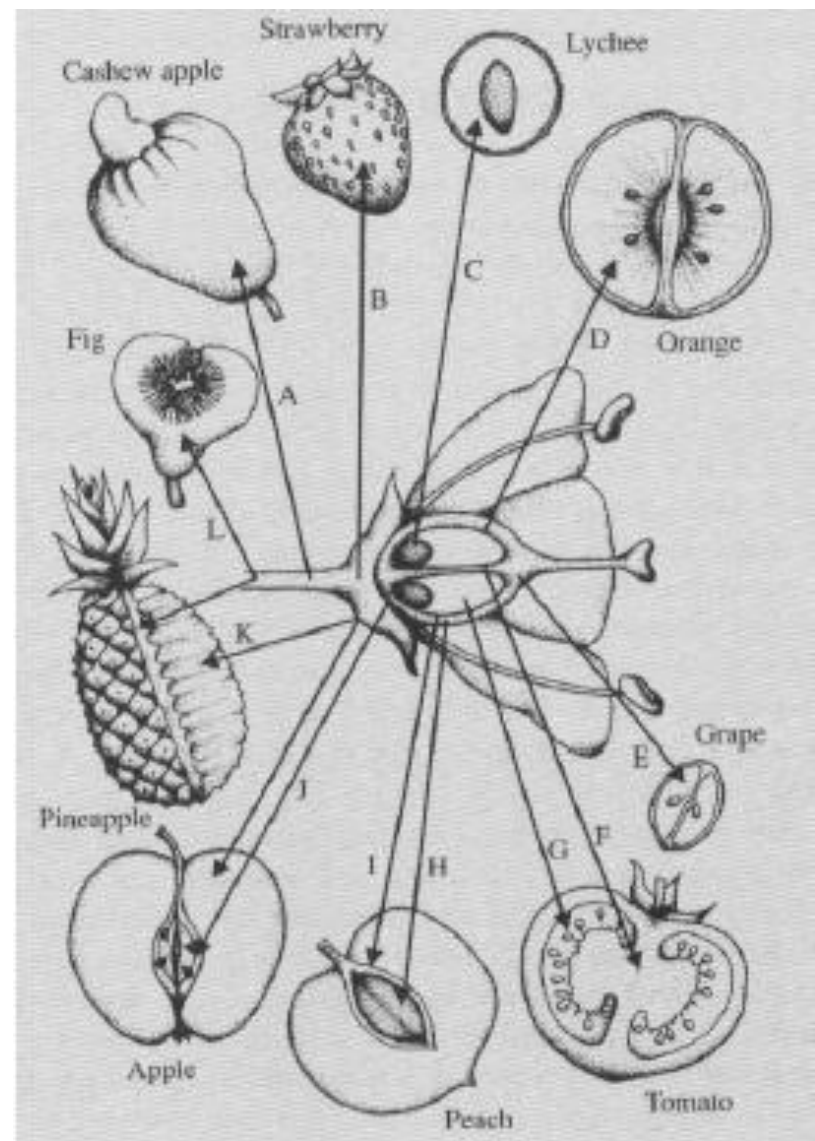
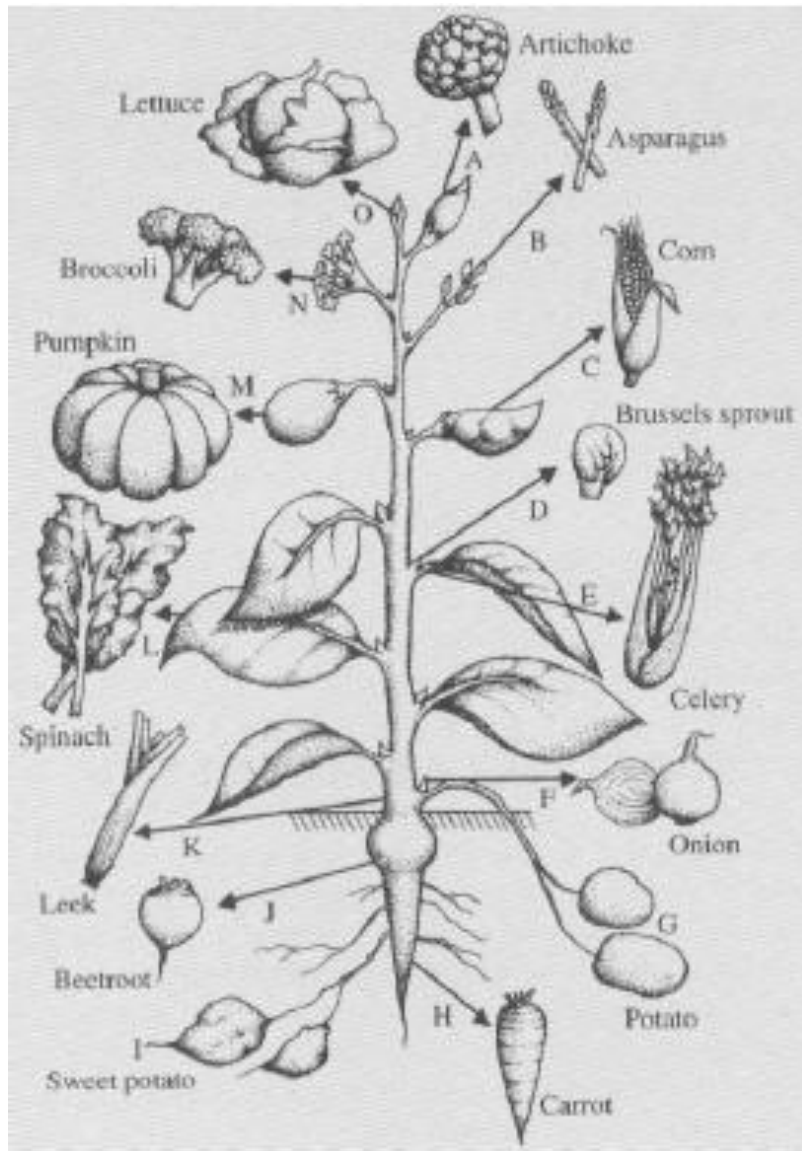
What is “The postharvest science”

The postharvest science include the study of the handling conditions from harvest up to the consumption, it include either the physiological or pathological factors leading to the produce senescence

Our function is to:

Reduce losses and maintain the quality of marketing and health of the produce by technologies, mainly environmentally friendly, that will minimize the physiological and pathological senescence of fresh and processed produce

Reduce losses and maintain the quality of marketing of different types of agricultural produce



Part of the plant that develop agricultural products Part of the flower that transform into fruits/vegetables.

Another definition for Postharvest Pathology

The possible way to modulate the senescence of the stored fruits.



It should be clear that :

Most post-harvest technologies that we deal with, modulate the metabolic changes in fresh produce, by inhibiting respiration and losing water.

Technologies and strategies for delaying physiological and pathological include:

1. Reduction of temperature during harvest, during transfer to the packing house and during storage (effect on respiration and ethylene production)
2. Reduction of oxygen and increase of CO₂
3. The use of growth regulators to change growth and development and maintain freshness
4. Harvest at the right maturity stage
5. Modulation of the relative humidity
6. The use of packaging
7. The use of coatings
8. The use of ethylene inhibitors



“Via Dolorosa”

The fresh produce have a very difficult way from picking until reaching the consumer

What senses do we use when buying fresh produce, and why?





Properties of fresh produce after harvesting

1- The product is still alive and breathing (produce CO₂)

Sugar + Oxygen → Water + Energy and Heat



Respiratory results:

- Loss of internal food reservoir
- Loss of taste mainly sweetness
- Weight loss
- Heat release that raises refrigeration expenses
- Discharge of CO₂ that requires proper ventilation



Properties of fresh produce after harvesting

1- The product is still alive and breathing (produce CO₂)



However there is no more sources of:

Water

Light

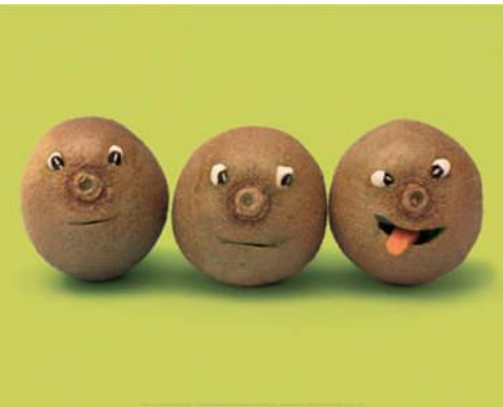
Nutritional sources

Oxygen

Therefore:

Produce with a high respiratory rate- will have short storage period and shelf life, while

Produce with a low respiration rate – will have longer storage and an relatively long shelf life.

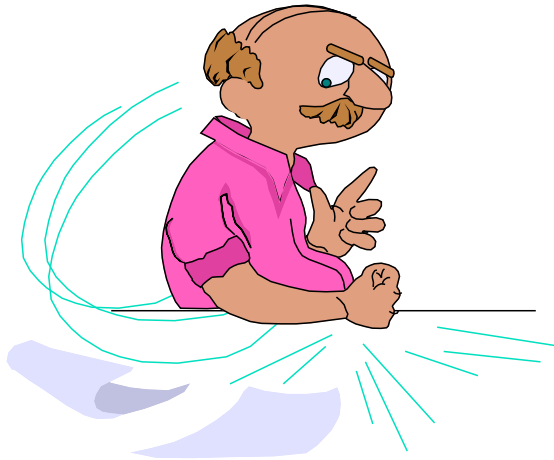


Further Difficulties to preserve quality...

1. The fruit condition before harvesting (historical background)
2. Injuries as a result of harvesting
3. Mechanical damage (field packaging, transportation to packing house)
4. Gravimetric orientation (flowers)
5. Physical pressure (tight packaging in packing house)
6. Low/high temperature injuries
7. Low humidity change in the atmosphere
8. Pathological stress and insect attack

So what is considered losses of the produce?

Any change in the quality and eating capability of the fresh produce that prevents its consumption by consumers



The consumer is losing again.

The loss occurs from the moment of harvesting until the produce is eaten or processed

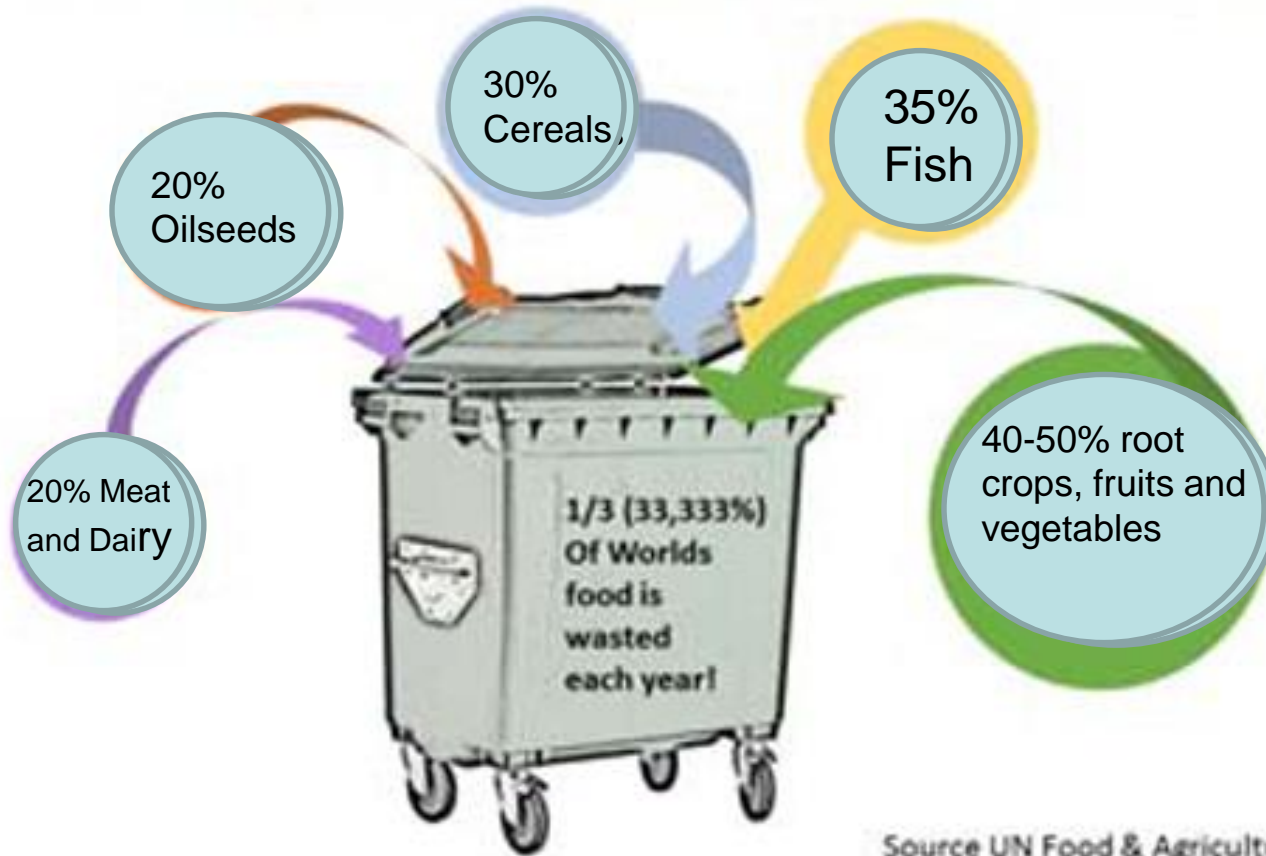


1.3 billion tons of food are lost or wasted every year worldwide (FAO, 2012)

One-third of the world's food produced; From about 33 to 45% fruit and vegetables

World considerations of losses!

Annual losses



Food loss chain values

Developing countries

Developed countries

25-40%

Before harvest

5-15%

30-50%

**Harvest, storage and
transport**

5-20%

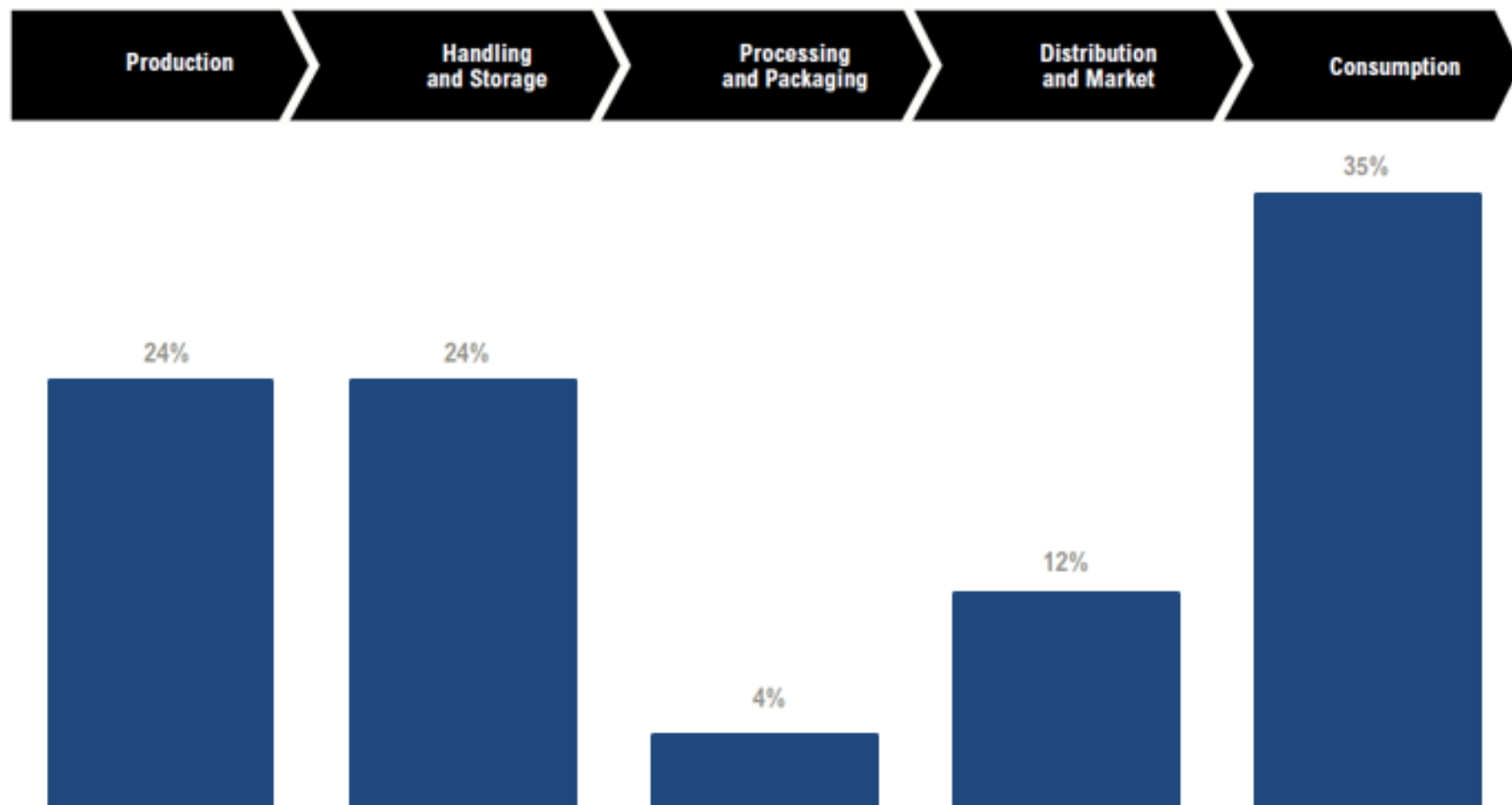
1-10%

**After harvest, at
home, work and
restaurant**

5-30%

Food loss and waste occurs more 'near the fork' in developed regions and more 'near the farm' in developing regions

100% = 1.5 quadrillion kcal

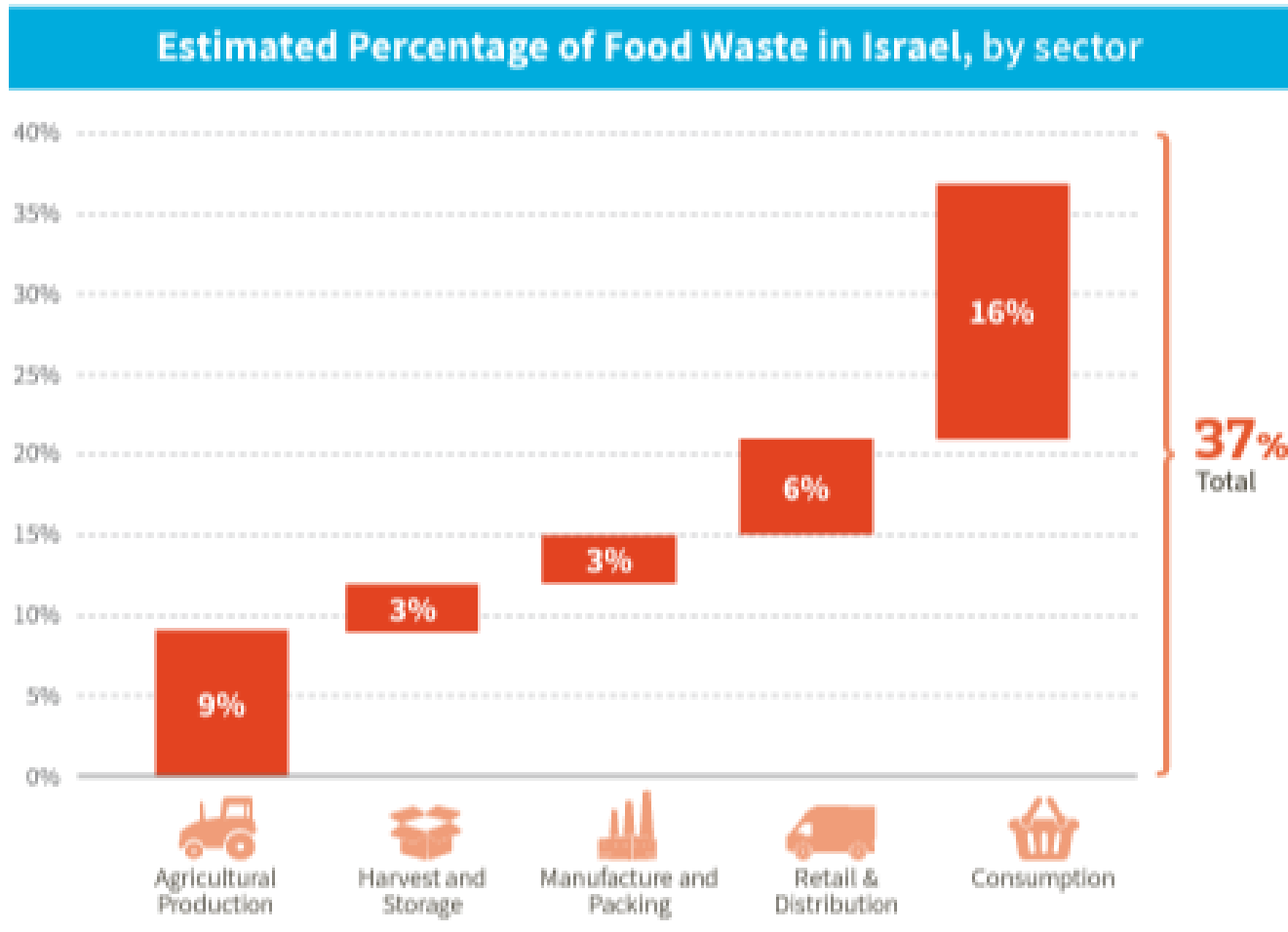


Food loss in Israel

According to the National Insurance Institute, the “average Israeli family throws away food weighing 1152 kg with a monetary value of about NIS 4200 family/per year.”

**Israel loses 2.4 million tons of
food a year worth NIS 20.3
billion shekels**

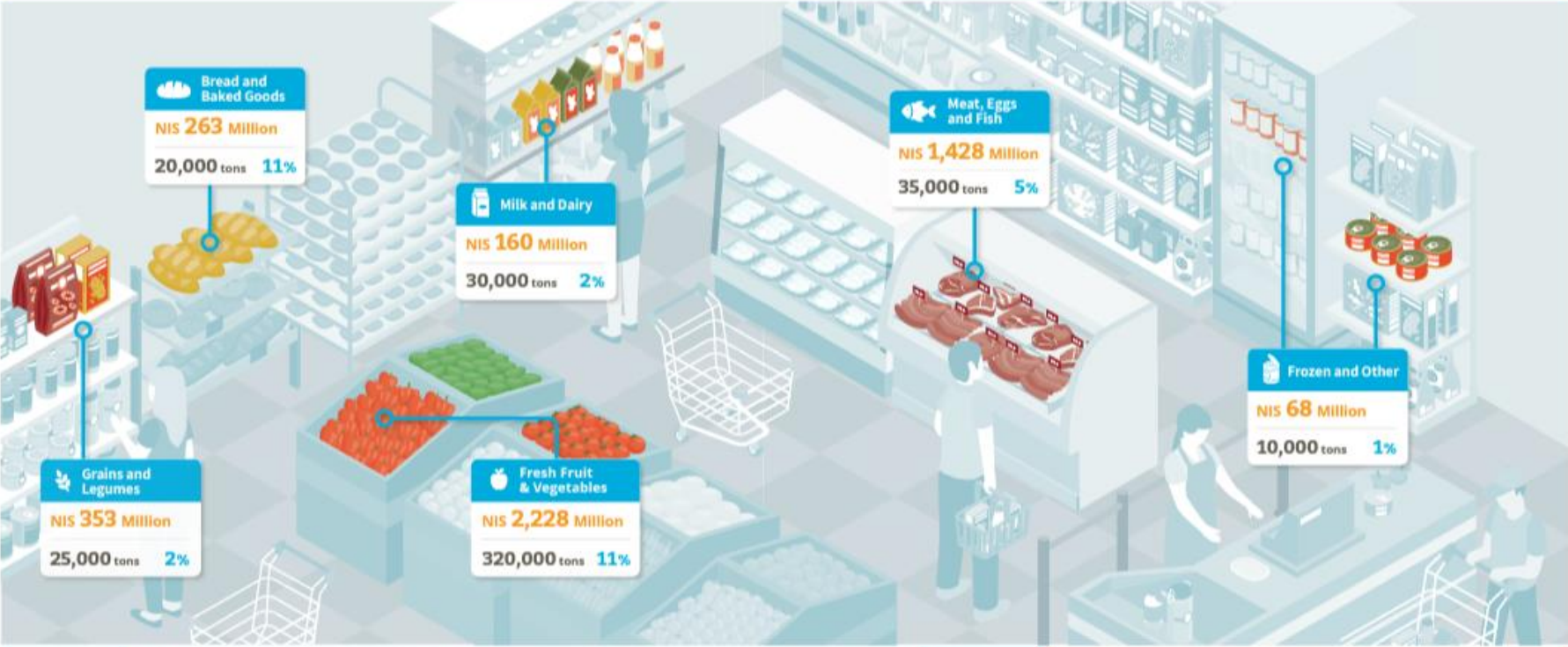
Estimated losses during the food chain in Israel



Source: BDO estimates

Estimated losses in NIS during the food chain in Israel

Financial Loss in the Retail and Distribution Sector



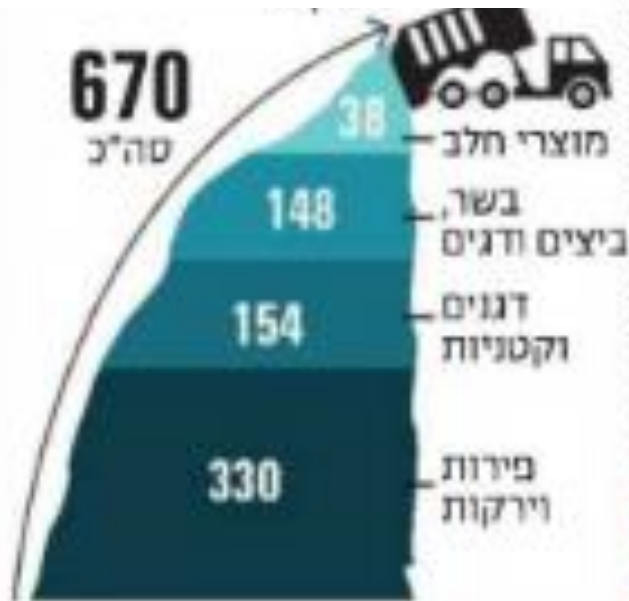
Primary Causes of Waste

- Expiration Date
- Aesthetic Defects
- Damaged Food

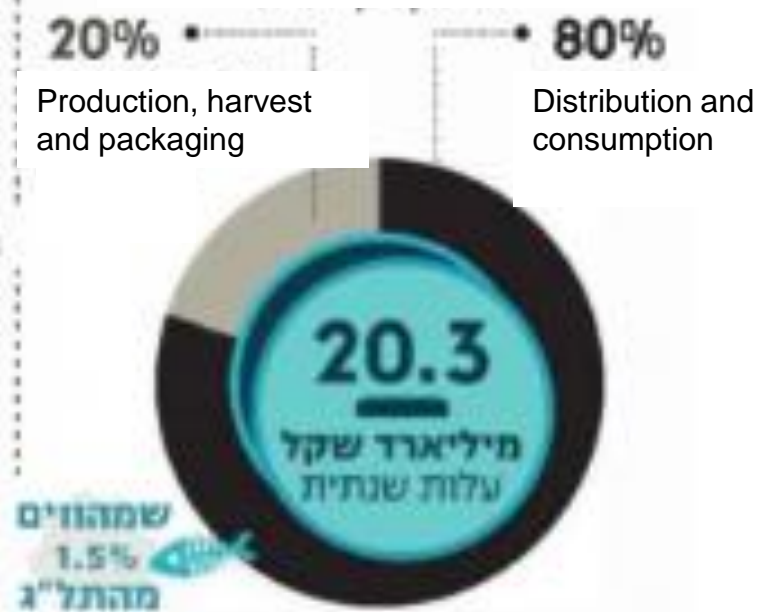
Value of Loss **NIS 4.5 Billion**

The consumers are the main contributors to food losses

Evaluation of monthly food losses/family (shekels)



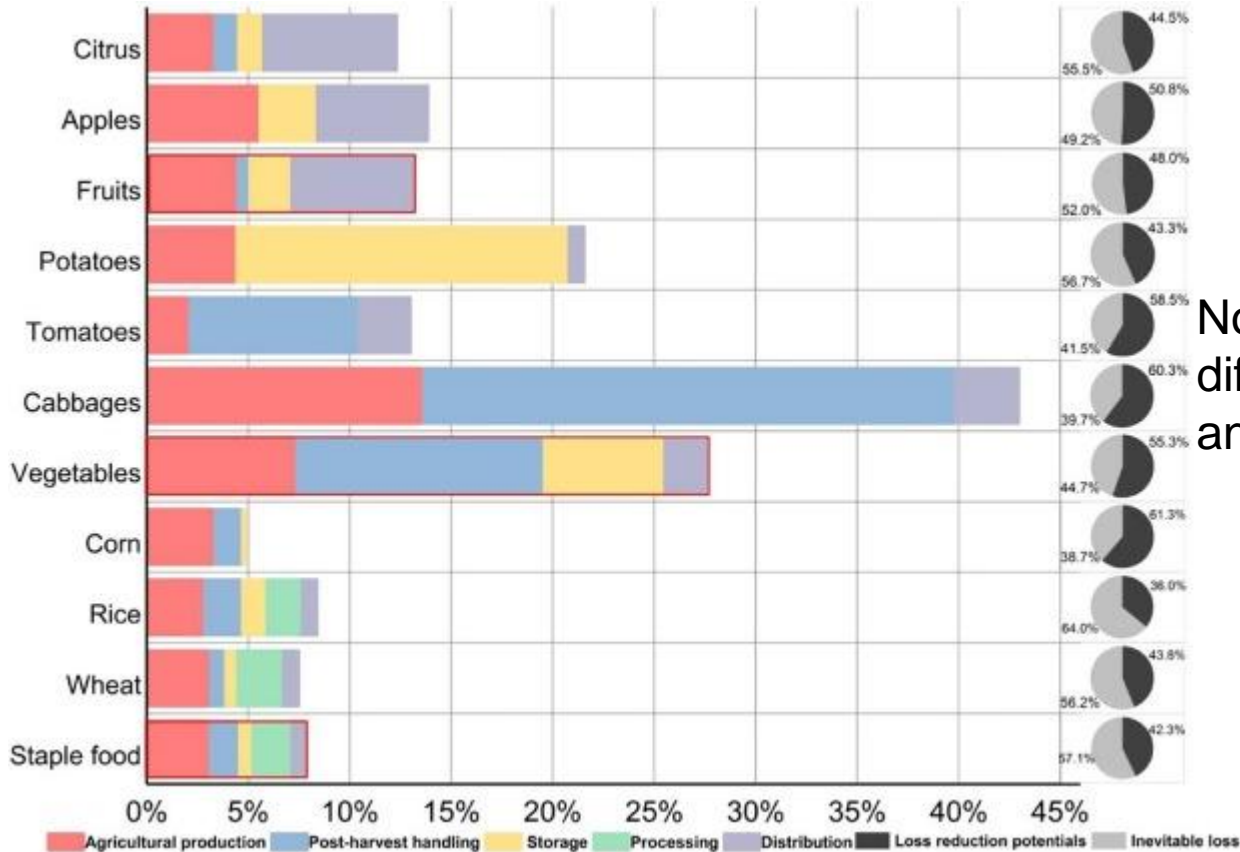
Percent of losses at different stages of the food chain (2019)



מקור: דו"ח המסודר להגנת הסביבה ולקט ישראל

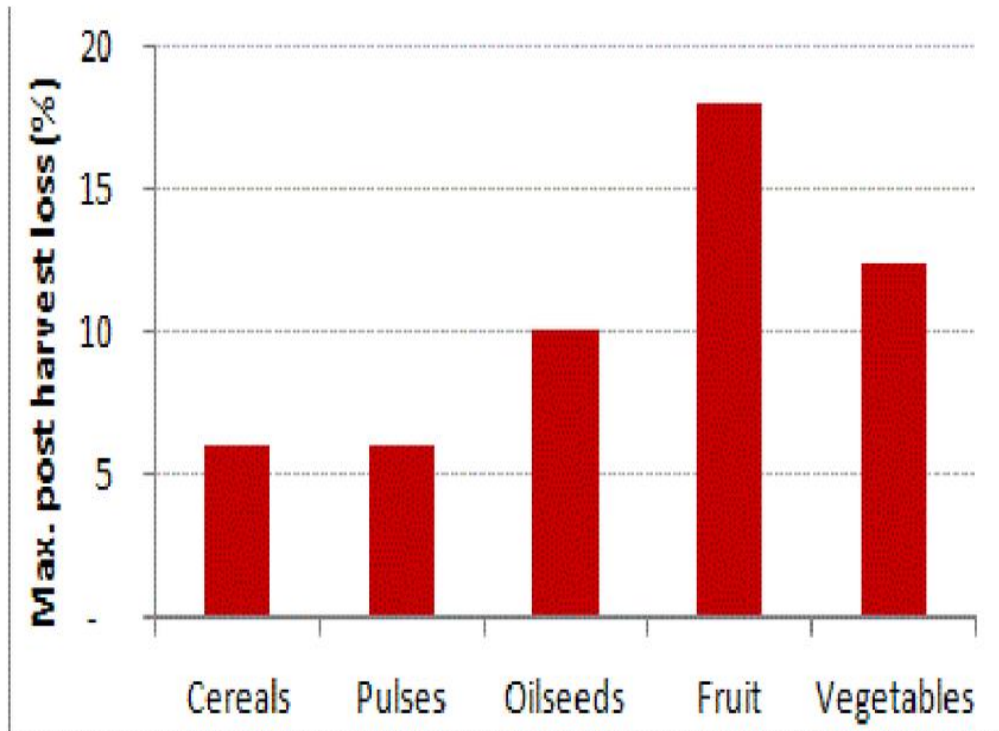


The total post-harvest loss of agricultural products in China exceeds **300 billion yuan each year (46 billion \$)**, which comes out to 10 million hectares of cultivated land. Provinces including Sichuan, Hubei, Hebei, Gansu and Fujian complain about insufficient subsidized facilities.



Normalized food loss rates of different agrifood products and loss reduction potentials.

Postharvest loses in India



Times of India

Estimated post-harvest losses in major crops, agricultural products

Fruits



Vegetables



Indian News



45%

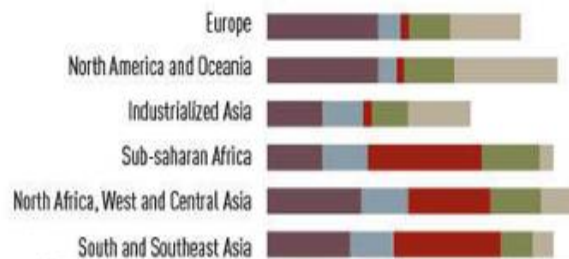
FRUIT & VEGETABLES FOOD LOSSES

Along with roots and tubers, fruit and vegetables have the highest wastage rates of any food products; almost half of all the fruit and vegetables produced are wasted.



3.7 trillion apples

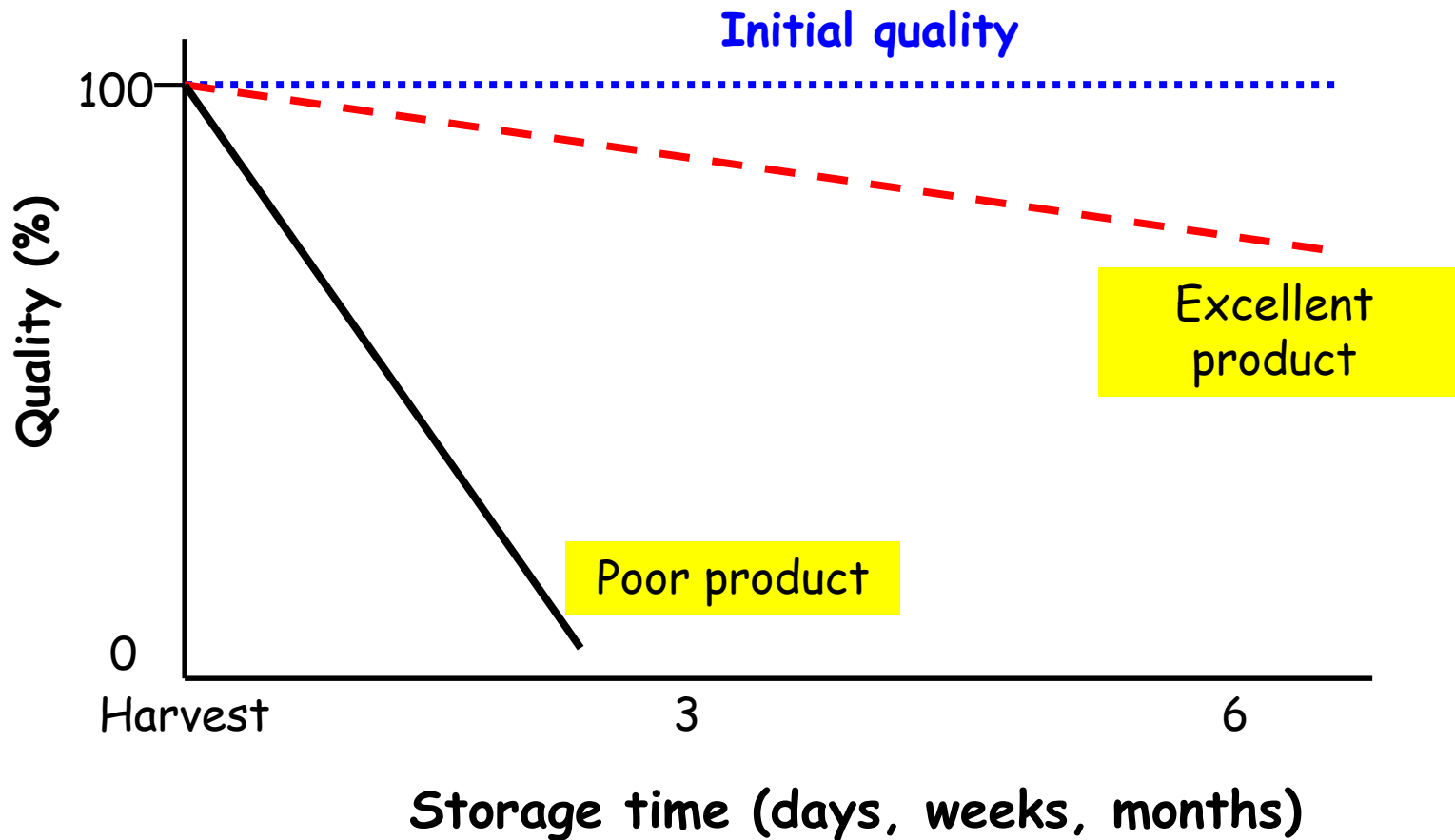
■ Agriculture ■ Distribution
■ Post-harvest ■ Consumption
■ Processing





**You can't improve the quality after picking.
But it can be preserved!!!**

Quality over time



Summary and definition of quality

Incoming Junk quality = Outgoing Junk

Quality is depending on :

- 1. Cultivar, 2. Weather**
- 3. Treatments before picking**
- 4. Treatments after picking and**
- 5. All together**

وَيْسُوعُ دَوْلَةُ

طريق الآلام

VIA DOLOROSA

Green House





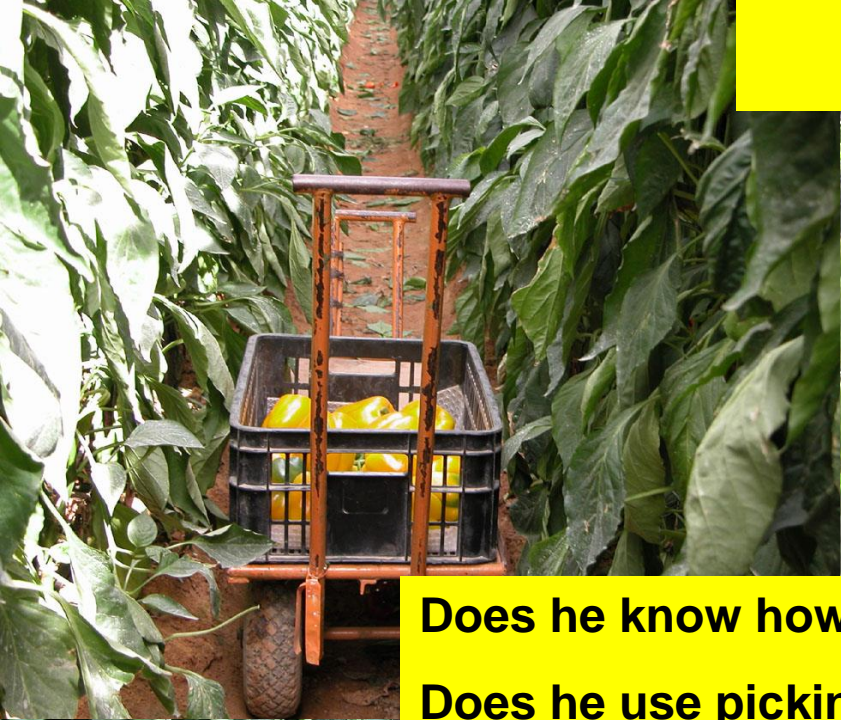
Harvest





Sanitation

Harvest



Does he know how to pick?

Does he use picking tools?

Does he know the best maturation stage?

For how long does he pick during a day?

What hours?

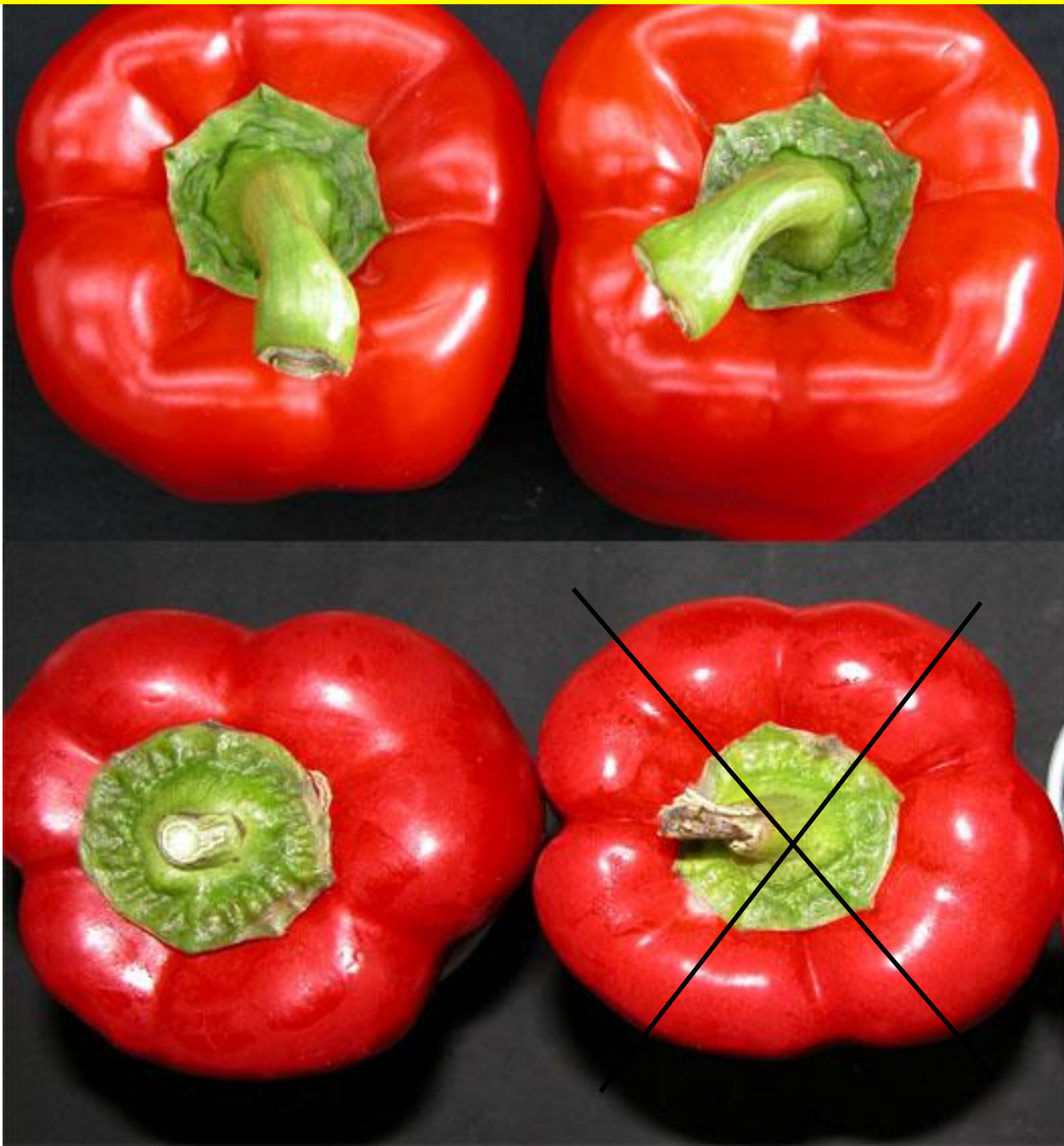
Where do he place the produce?





~80-85%

How to harvest the pepper



Impact of harvesting time on mint quality



6:30



10:30
Contribution
of sugar
metabolites



13:00

Impact of harvesting time on basil quality



Morning harvest



Afternoon Harvest



Packaging and transportation from the field to the packing house





Packaging and transportation from the field to the packing house





Prevention of cherry drying in by wet towel during the transport from the orchard to the packing house.



Packing house?





Toilets and clean showers

הכניסה לזרים אסורה!
NO UNAUTHORISED ENTRY!
Посторонним вход запрещен!
ممنوع الدخول للغيراء!
အတားအဆီး
ထိန်းသိမ်းမှု

לרחוץ ידיים!
WASH HANDS!
Обязательно мыть руки!
اغسل يديك الآن!
ล้างมือทันที

אסור לאכול ולשתות בבית האריזה!
NO EATING OR DRINKING IN THE PACKINGHOUSE!
Запрещается есть на территории!
ممنوع الاكل والشرب
في مصنع التغليف!
ห้าม
กินหรือดื่มน้ำในโรงแพ็ค

חובה לבוש בגדי עבודה וכובע!
PROTECTIVE CLOTHING AND A HAT MUST BE WORN!
Обязательна спецодежда!
ليس ثياب العمل والقبعة إلزامي!
ต้องสวมชุดและหมวก
สำหรับทำงาน

אסור לעשן!
NO SMOKING!
He курите
ممنوع التدخين!
ห้าม สูบบุหรี่

אסור להכניס דברי זכוכית לבית האריזה!
NO GLASS ALLOWED IN THE PACKINGHOUSE!
He вносить стеклянные вещи!
අඟහළු වස්තුවන්
අවුදායාමට
අවුදායාමට
ห้าม
นำแก้วหรือขวด
เข้ามาในโรงแพ็ค







Cleaning of the packing house; Use a damp mattress to cool

Cleaning and disinfecting in hot water



Sorting in water (water temperature higher than fruit temperature)



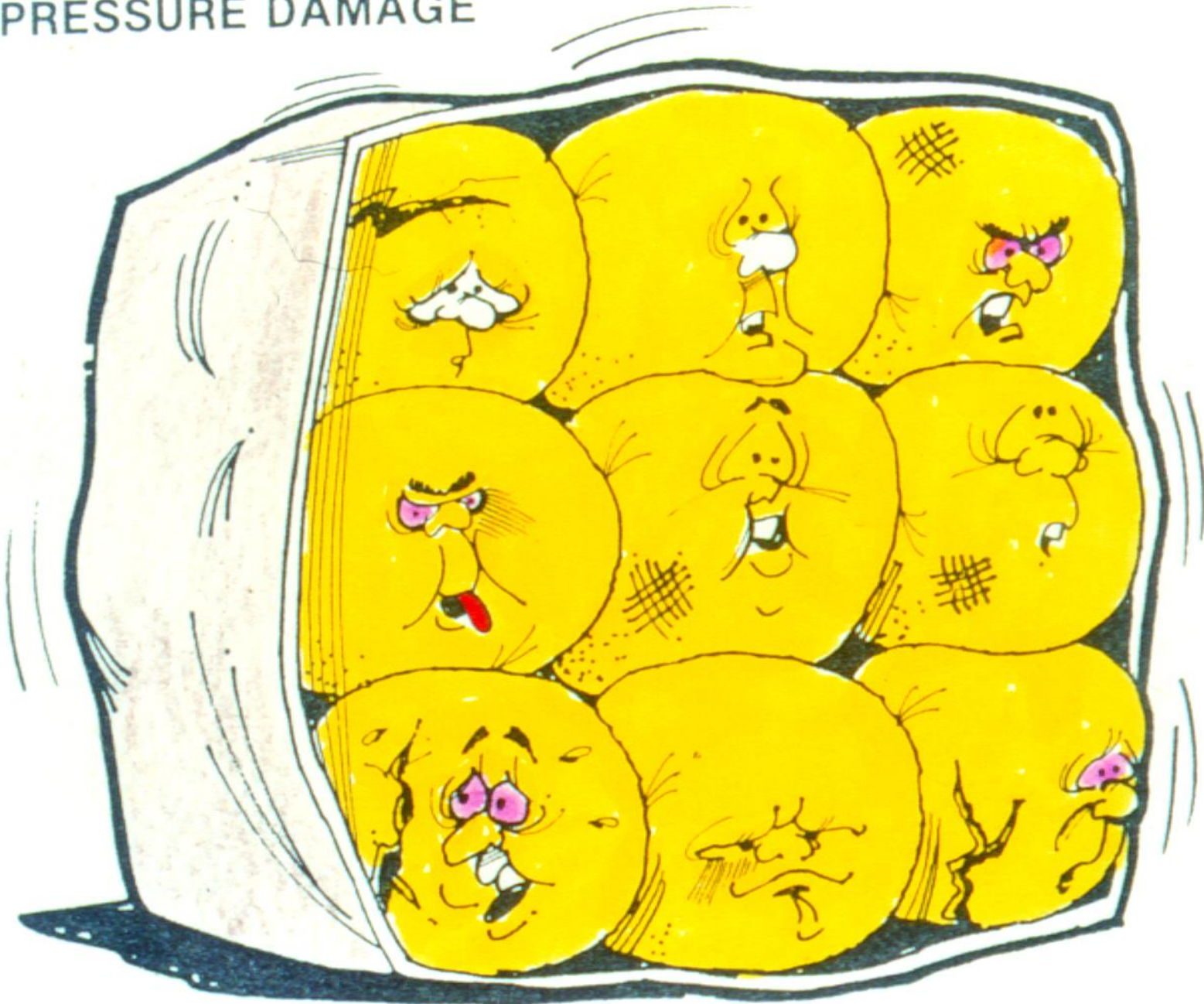
Proper container for general sanitation using chlorine (Brazil, 2015)

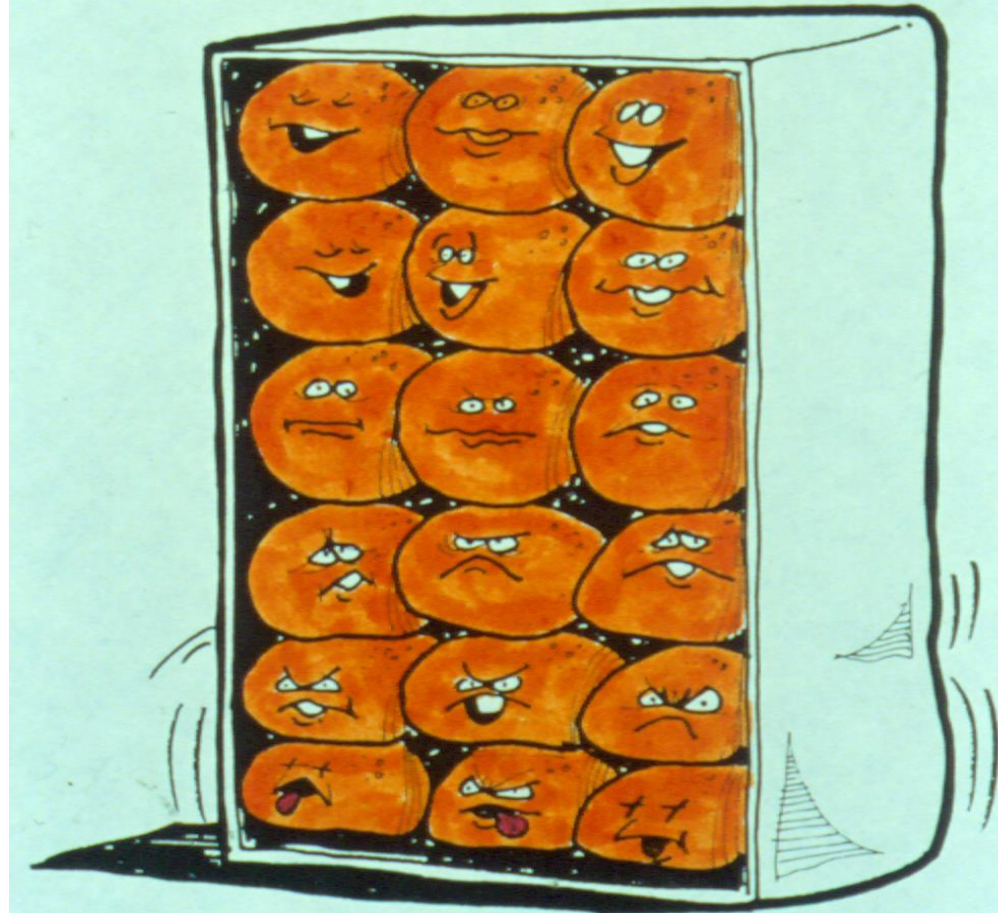
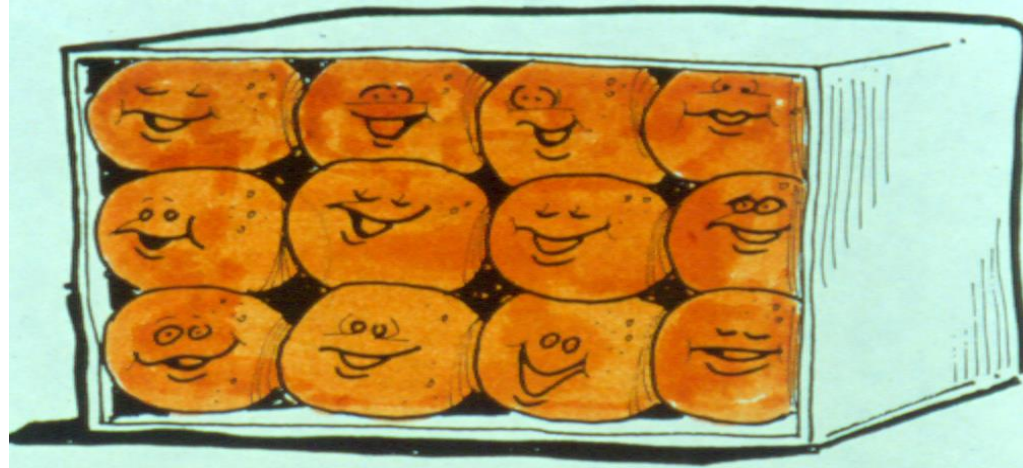


Sorting and packing the fruit – adequate lighting(CA, USA)



PRESSURE DAMAGE



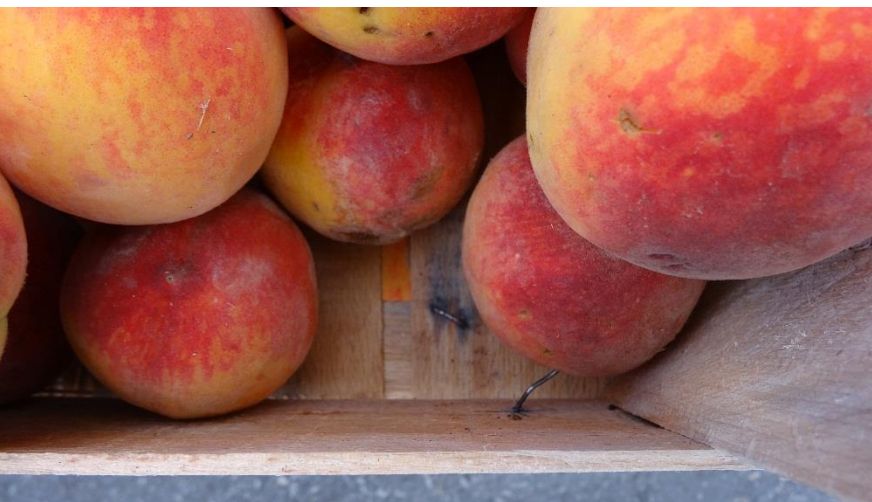
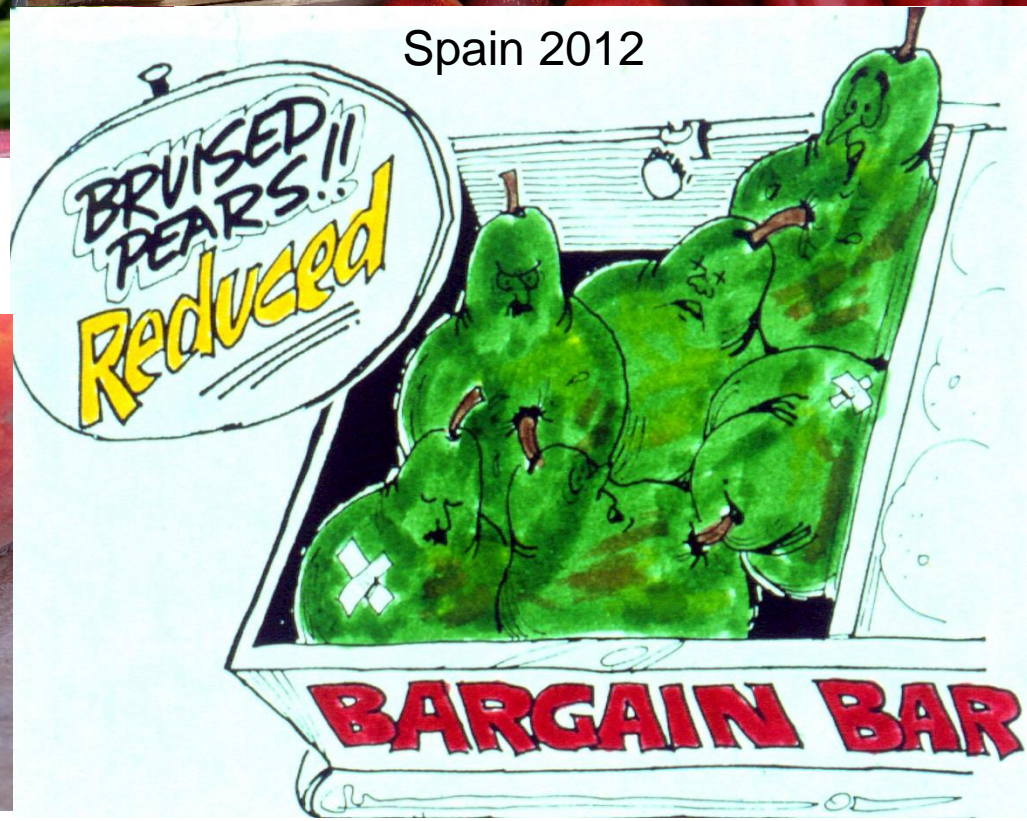




Thailand 2015

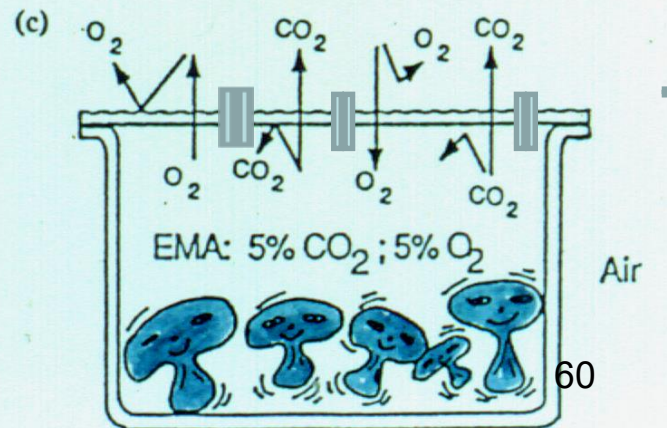
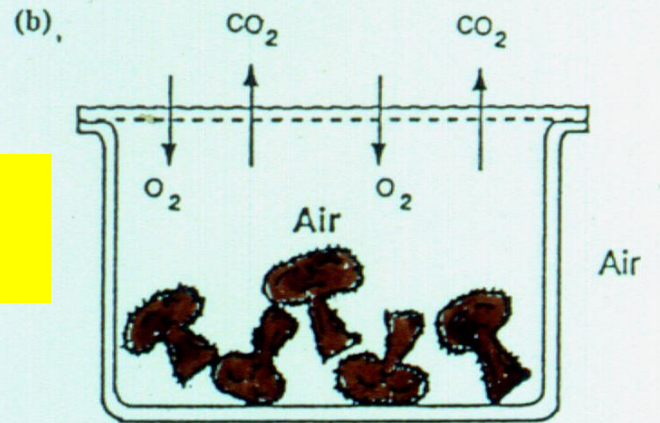
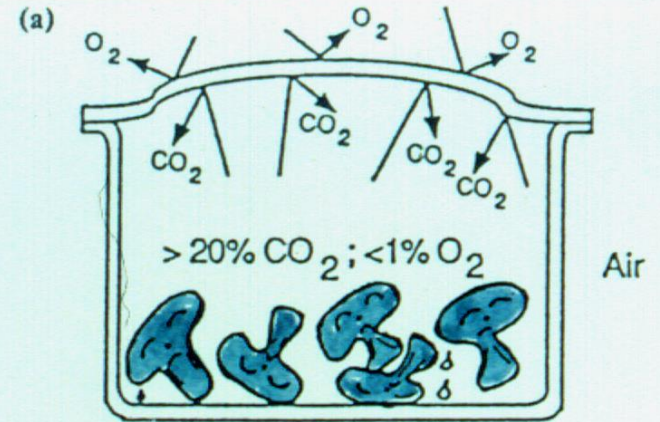


Spain 2012





Packaging or wrapping in plastic bags - a modified atmosphere



Smart packaging – with or without micro-perforation release



Palleting

Reinforcement with polyethylene films



Non proper
palleting



Storage (Israel, Europe)



- Optimal temperature
- Relative humidity (RH)
- Protection against high CO₂
- Protection against ethylene

The optimal storage temperature depends on the product and its ripening status during harvesting (from a few days up to 14 months)



Green pepper	10C
Red pepper	7 C
Green Tomato	15C
Red tomato	12C
Eggplant	12C
Basil	12C
Mango	11C
Grapefruit	11C
Orange	6C
Apple	0C
Lettuce	0C
Cucumber	10C



**High humidity -
prolonged storage**



Fog to increase humidity in storage rooms

Effect of moisture on pomegranate quality in prolonged storage



95%



80%



65%



Load while maintaining the cooling chain



Transport (Thailand)







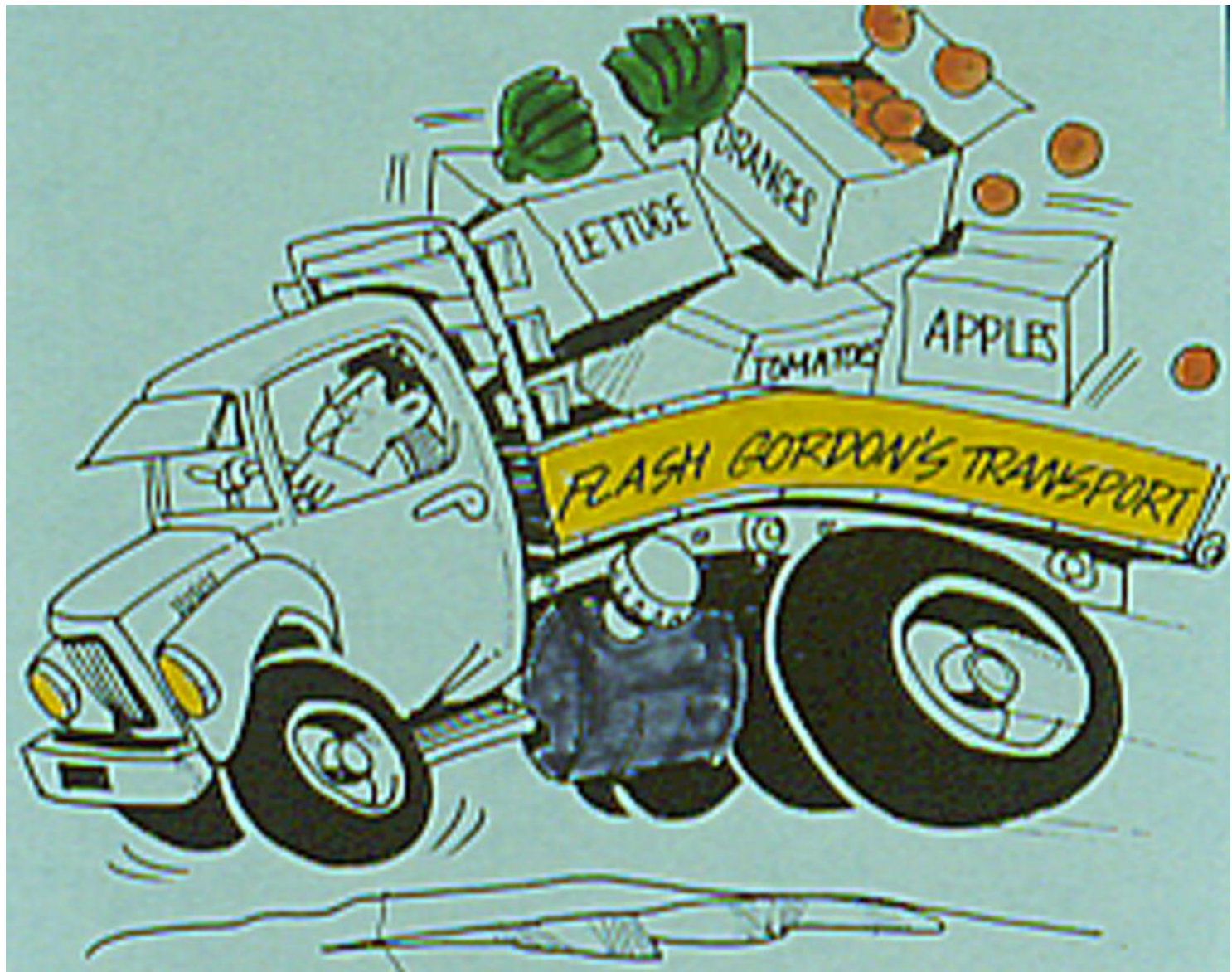
Refrigeration truck is not used for cooling but only for maintaining the temperature

**Maritime exports
on refrigerated
ships**





Export by air



Speed of the transport



Transport to Europe, France



Transport to from Packinghouse to the supermarket



Damage during unloading of the surface





India, 2012

Commercial Market, Israel











Open market Australia



Open market China

Buy produce exposed to the sun or under shade?



Cooled supermarket in Taiwan



Cooled supermarket in Taiwan



Cooled supermarket in California

**Fruits
from
Taiwan**



Fruits from Taiwan



Fruits from Taiwan



The proper "buy"



Sanitation at home



The proper refrigerator

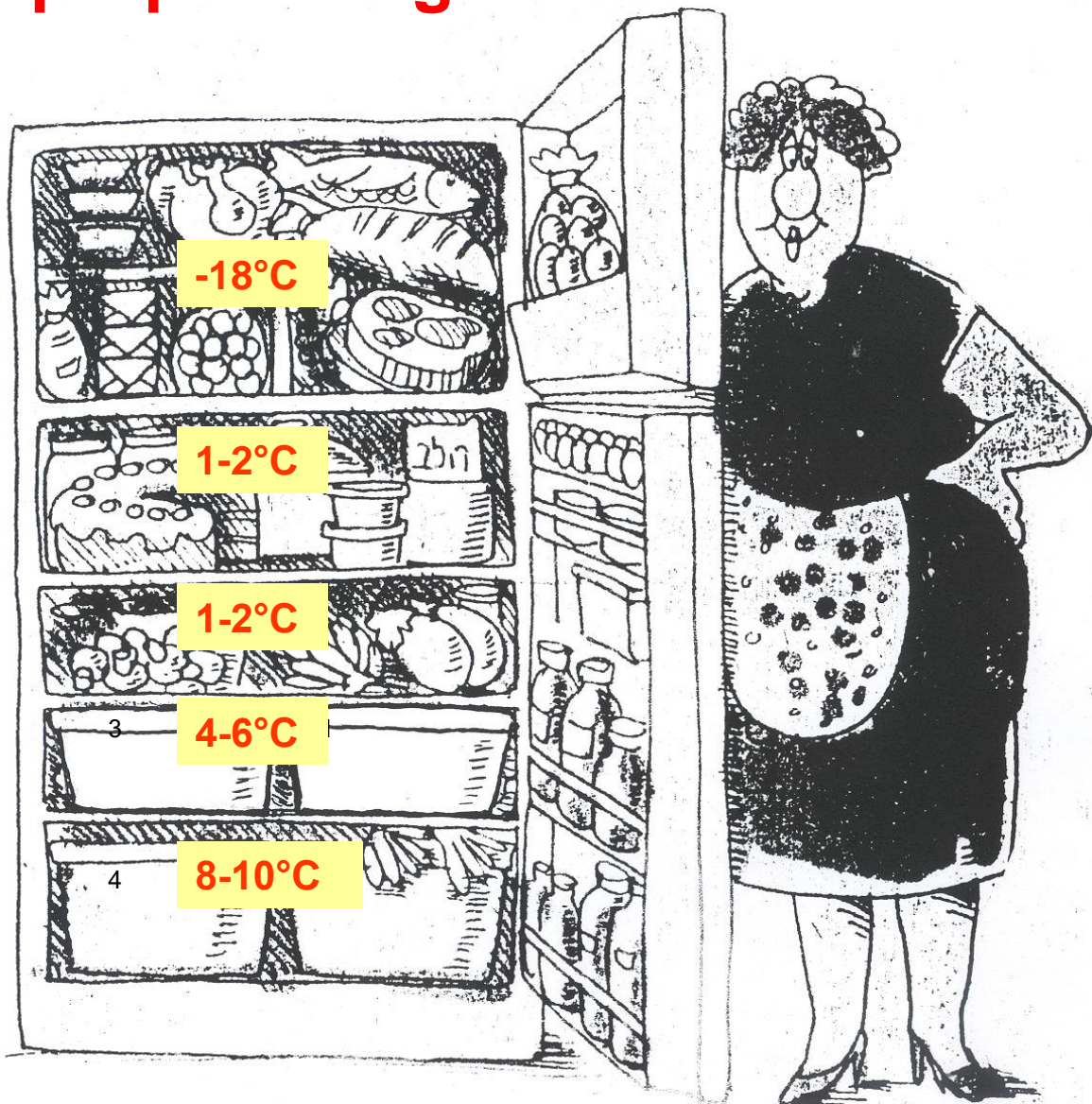
Frozen vegetables: corn, beans, peas, broccoli, dates.

Strawberry in a closed basket, mushrooms, cabbage, packaged vegetables ready to eat: chopped lettuce, "babysitting" (rocket, roccola, etc.),

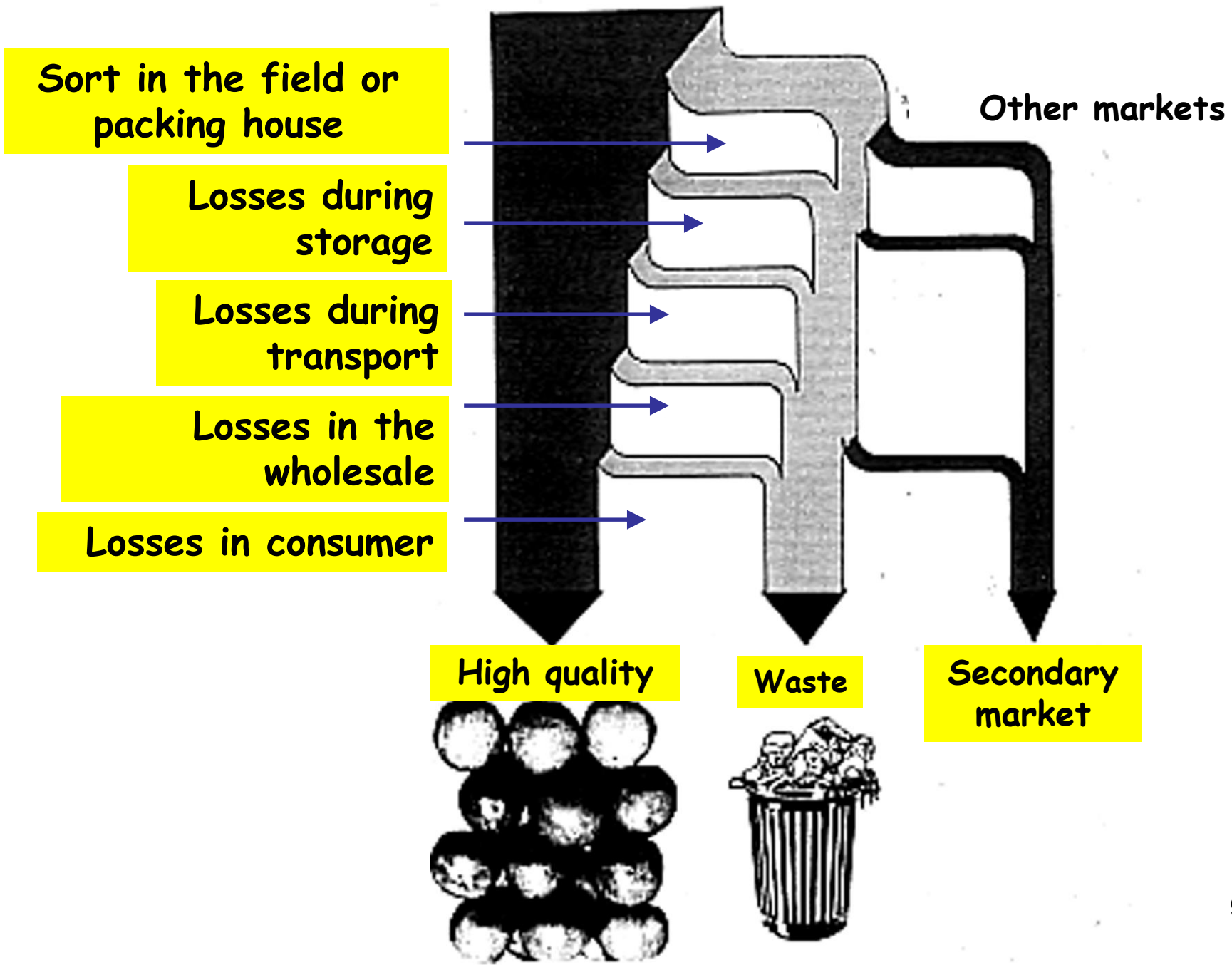
Pears, grapes, seeds, persimmon, cauliflower, carrots, lychee. potato

Melon, pepper, watermelon, avocado

Mango, guava, cucumber, tomato, citrus.



Summary- Freshly harvest fruits



<https://www.youtube.com/watch?v=IFImjzUkdJE>

<https://www.youtube.com/watch?v=rOOQB4hZHC4>

The story of the Brussel sprouts

<https://www.youtube.com/watch?v=jjgJR-NL06k>