



# Handbook

## *Harvest & Post Harvest Management*

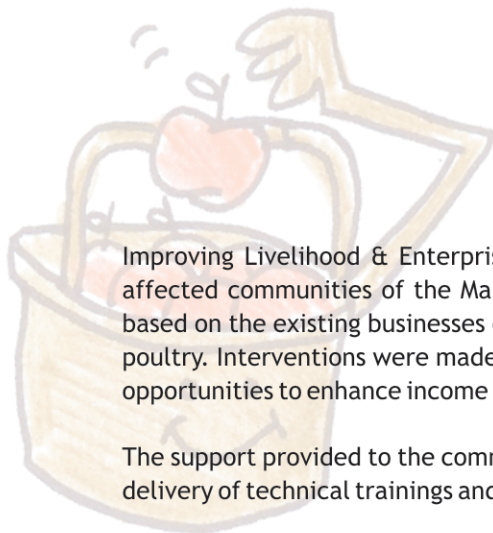


June 2008



**USAID**  
FROM THE AMERICAN PEOPLE





## Acknowledgment

Improving Livelihood & Enterprise Development (I-LED), a USAID funded program was designed for the affected communities of the Mansehra and Bagh districts. I-LED programs focus on building back better based on the existing businesses of the community (before earthquake) such as agriculture, livestock and poultry. Interventions were made to help these businesses build on their inherent strengths and to provide opportunities to enhance income generation, local employment, and increased economic activities.

The support provided to the community was through Matching Grants (Financial Assistance) linked with the delivery of technical trainings and skill enhancement relevant to their businesses.

To address the deficiency of existing knowledge, a series of training manuals was created to support nursery and orchard growers. The following topics were included in this series of modules:

- |                                     |                                  |
|-------------------------------------|----------------------------------|
| 1. Introduction to Fruit Production | 2. Orchard Establishment         |
| 3. Orchard Tree Pruning             | 4. Orchard Irrigation Management |
| 5. Harvest/Post Harvest Management  | 6. Orchard Nutrient Management   |
| 7. Small Farm Business              | 8. Integrated Pest Management    |
| 9. Nursery Management               |                                  |

This interactive training series was designed for both trainers and potential business owners (potential partners). Pilot training were also conducted at village level with real farmers groups to test these modules. These modules were also evaluated by a diverse group of training providers and technical expert's to provide as appropriate a training resource as possible.

The communities, farmers and technical expert from agri industries appreciated the I-LED effort for the development of these modules and found the material to be an excellent contribution towards farmers' livelihood initiatives.

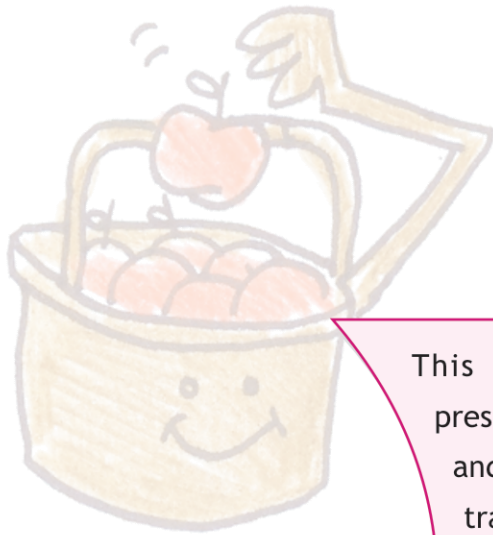
We acknowledge and appreciate Dr. John Bellow's dedicated technical input for the development of these modules, Empowerment thru Creative Integration (ECI)'s contribution in developing this complex subject into to participants handbook and instructional guide for trainers, easy and absorbable methodologies; and suitable visualization for non-literate farmers.

We also appreciate the support, inputs and suggestions of CNFA training department, agriculture and horticulture experts and local organizations (Hazara Agriculture Research Station, Bafa Agriculture Research Station, Cabi South Asia, CITRUS "Committed for improvement transformation& resource up-gradation of the social sector and Agriculture expert of CNFA I-LED) who provided continue support in providing technical inputs and suggestions to make this material more beneficial to the rural communities.

Various references from a variety of sources were used to develop and validate the contents. Its is not possible to individually acknowledge each source .However we hope this series of modules will not only help the farmers of rural areas but all relevant institutions, organization and trainers will also be benefited with the provided information. We are deeply grateful to very one who has gifted even a small input to make these materials unique and useful for the target groups.

These modules are CNFA I-LED's contribution towards knowledge transfer within the horticulture sector .We would therefore like all users to feel free to copy, distribute, display modules and benefit the sectors and more specifically the farmers. Electronic copies may be found at <http://www.cnfapakistan.org>

CNFA I-LED



## Forward

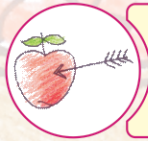
This training module focuses on presenting the importance of harvesting and post harvesting. The purpose of this training is to provide sufficient information to the orchard growers to use harvesting and post harvesting techniques for better sale and good profit. Farmers will also learn the correct methods of grading and sorting tips and to identify the right customer for the right fruit for better marketing results.

The training will produce better results if the presentation includes demonstrations and hands-on activities. It is suggested that the training schedule include the sessions for discussion, Q&A, demonstrations, the practical activities and hands on practice by participants.

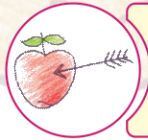
The training material has been developed to make the Handbook relevant for semi-literate and non-literate participants.

## Objectives

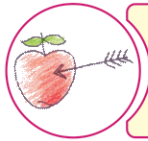
By the end of the training workshop participants will:



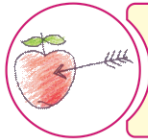
Recognize the importance of harvest and post harvest activities.



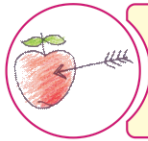
Understand the characteristics of fruit and how it affect the sale



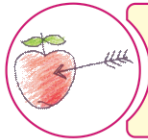
Recognize the different stakeholders involved in the purchase of fruits and their prime concern



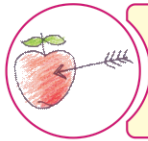
Understand the fruit storage life, different shelf life for different fruits



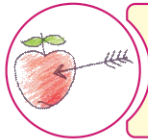
Understand the fruit ripening stages from immaturity to rotten and why it is important to know before harvesting the fruit



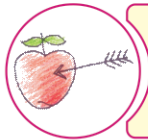
Recognize the difference between maturity and ripening in different fruit



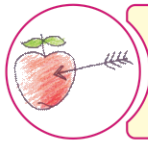
Understand the harvest practices and what needs to consider during harvesting



Understand what the key consideration after harvesting for a longer fruit life and better sale and profit.



Be introduced harvesting and post harvesting tools which affect the production and quality of fruits.



Be informed some good tips for fertilization and especially for different size of trees.



## Structure of the Module

### *Session 1*

**Importance of  
Harvest & Post Harvest**

### *Session 2*

**Characteristics of  
Fruit Quality**

### *Session 3*

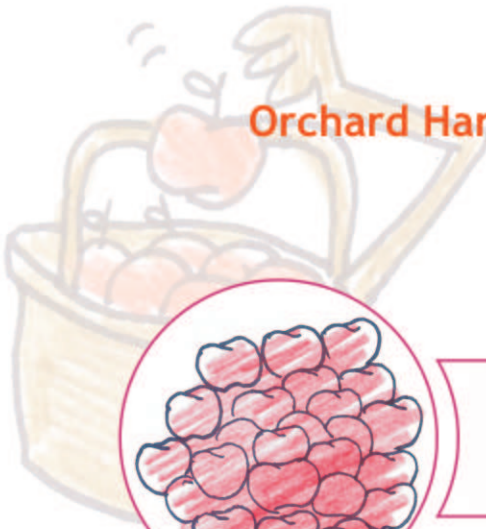
**Fruit Maturity  
(Ripening)**



## *Session 1*

# Importance of Harvest & Post Harvest

# Orchard Harvest and Post-Harvest Management WHY ?



1

Results in high quality yields at harvest

2

Proper harvest and post-harvest management is required to maintain this quality from picking until the sales are made



3

A better price for quality fruit

4

Fruit is alive - it continues to develop and change after Harvest

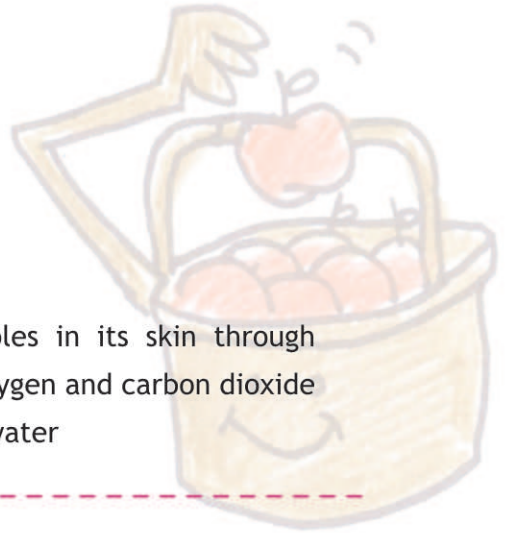


5

Being eaten is the end point where quality is most important



## How is Fruit Alive?



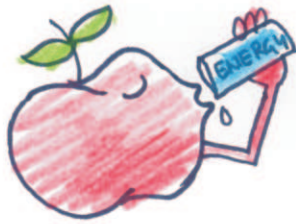
1



### Fruit Breathes

Fruit has small holes in its skin through which gases like oxygen and carbon dioxide can pass as well as water

2



### Fruit Uses Energy

Fruit uses the oxygen it breathes in to use the sugar that is inside it to create energy for it to stay alive.

3



### Fruit Sweats

While fruit is breathing, water leaks out of the fruit even though it can't be seen.

4



### Fruit Loses Weight

With all this breathing and sweating and using up of sugar, very slowly the fruit loses weight and becomes lighter.

5



### Fruit Grows Old

Fruit grows old after you pick it. This is also called ripening.

6



### Fruit Dies

Eventually fruit dies. Fruit becomes weak as it grows old and is more susceptible to damage, diseases, and fungus





## Session 2

# Characteristics of Fruit Quality

# Characteristics of Fruit Quality

1- Flavor



2- Color



3- Texture



4- Size and Shape



5- Nutritional content



6- Freedom from damages or blemishes



7- Shelf or storage life



# 1- Flavor



1

Sweetness



2

Acidity or tartness



3

Astringency or bitterness



4

Aroma or smell



## 2- Color

Fruits and fruit varieties have expected colors and color patterns,



Bananas are yellow, green bananas are recognized to be immature (not as sweet)



Red apples are more attractive when the red color is intense



Strawberry



Apple



Pear



Green Apple



Apricot



Banana



Peach

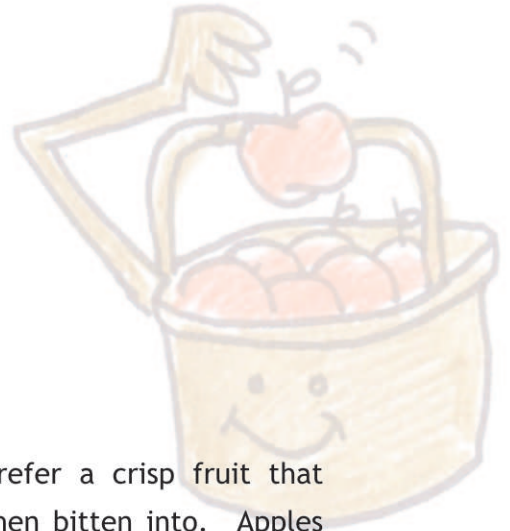


Orange



Plum

### 3- Texture



1



#### Crisp

Consumers may prefer a crisp fruit that snaps or cracks when bitten into. Apples that are mushy or mealy in texture are generally not preferred.

2



#### Not stony or Gritty

It is desirable that the flesh is much softer and much more juice.

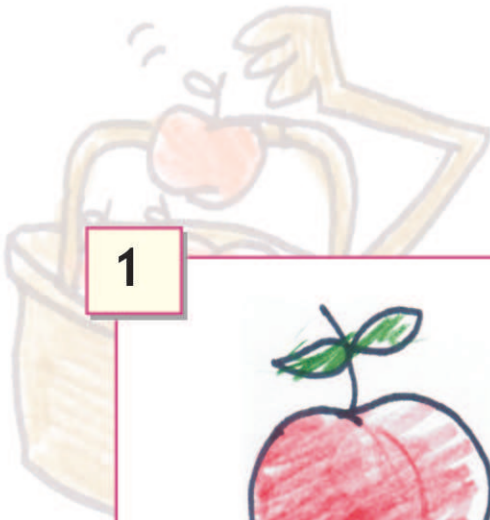
3



#### Soft and Juicy

Sometimes the term melting flesh is used to describe how the fruit behaves when it is eaten.

4- Size and Shape



1



Proper size

2



Too small (undeveloped or immature)

3



Too large  
(poor texture or weak flavor)

4



Deformed shape (unattractive)

5



Insect damage

6



Damage from crushing and bruising

## 5- Nutritional Content



1

Fresh Market



Not obvious to purchaser

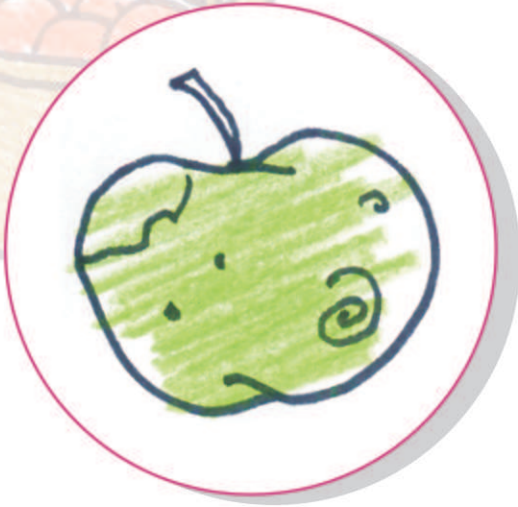
2

Processing Market

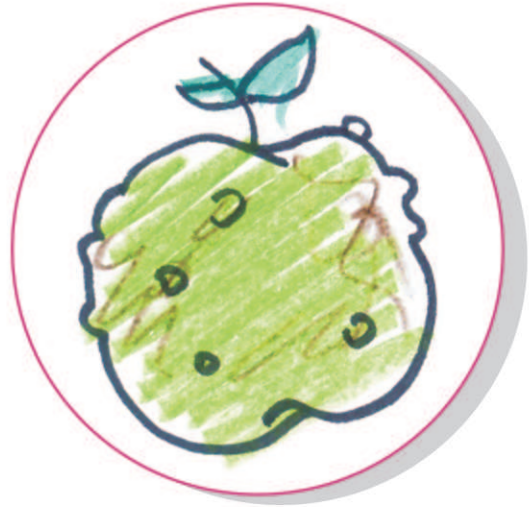


Not obvious to purchaser but often tested

## 6- Freedom from Damages or Blemishes



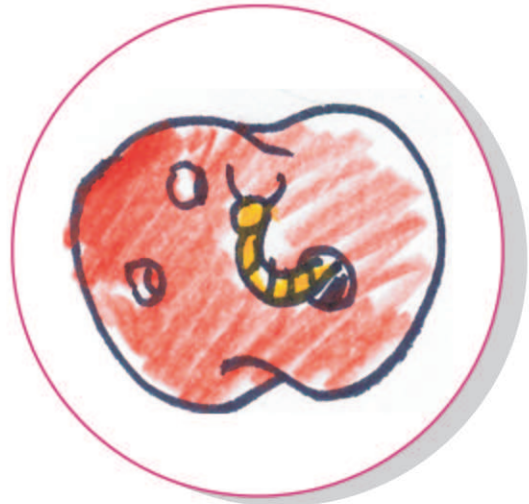
Pest and disease marks



Bites, scars, bruises, tears,  
dirt, fungus, sap



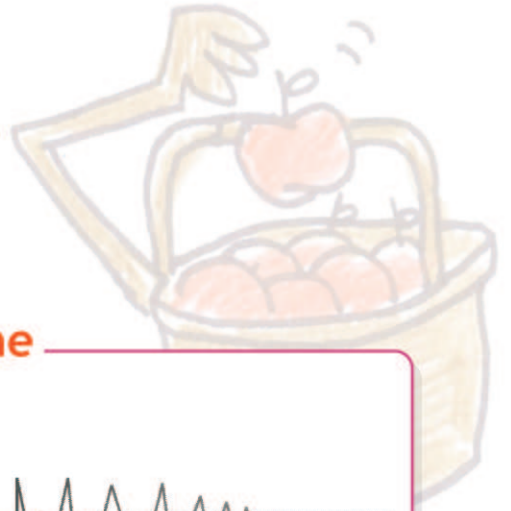
Suitable for processing  
depending on the type and  
extent of damage?



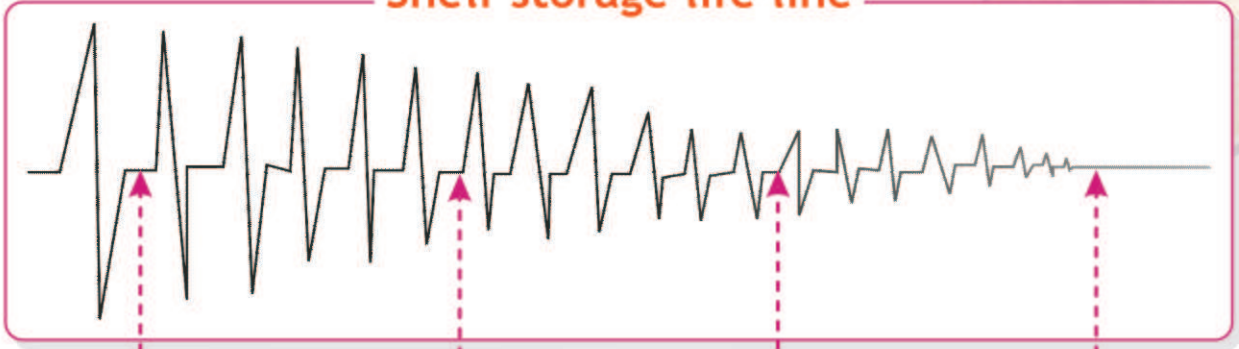
Diseased or insect infested fruit  
should never be marketed  
for human food or processing



## 7- Shelf Storage Life



### Shelf storage life line



Apple



Pear



Peach



Strawberry



## Effect of Quality on Consumers

1

### Appearance

Consumers make a decision to buy fruit based on the appearance and occasional the odor



2

### Flavor

Consumers decide to continue or to purchase again based on the satisfaction they experience from eating the fruit



3

### Price

Wholesalers decide to purchase again based on their experience of how your product sells and what price it attracts



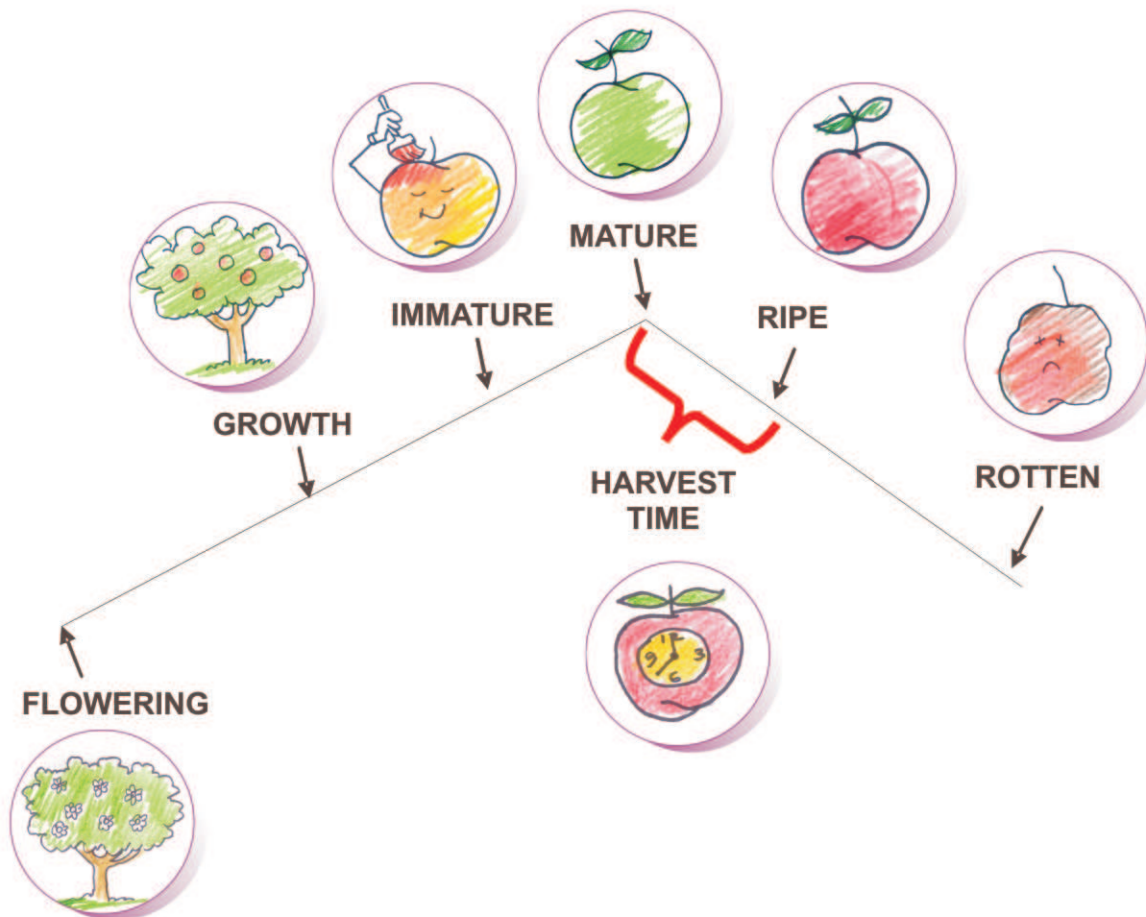
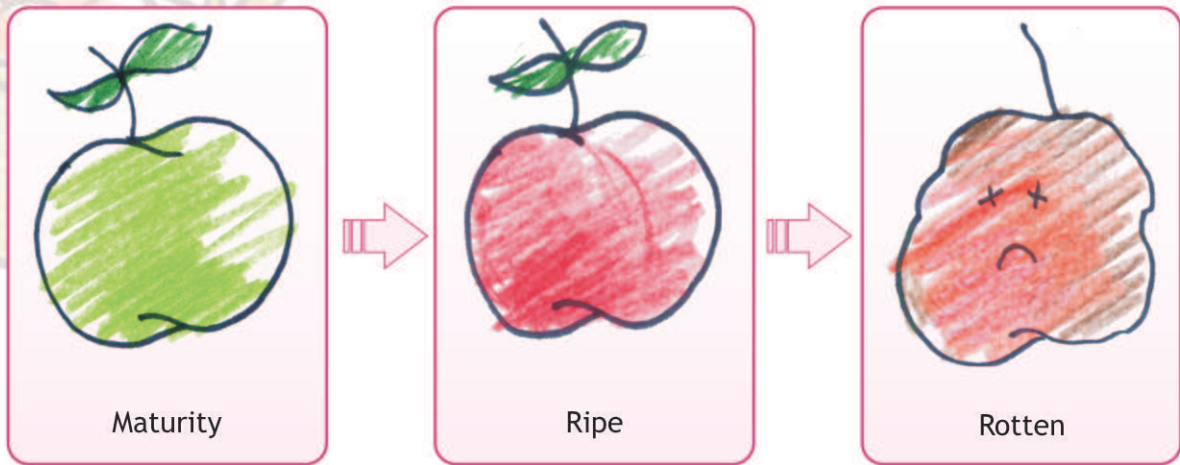


## *Session 3*

# **Fruit Maturity (Ripening)**

## Understanding Ripening

To understand ripening we must understand what several terms mean





## Maturity in Fruit

What happens as fruit becomes mature?

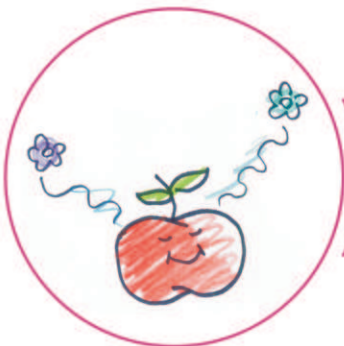
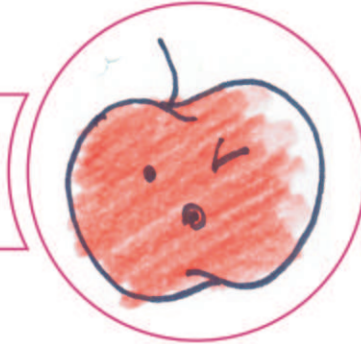


**1** Changes color



**2** Becomes sweeter

**3** Becomes more acidic

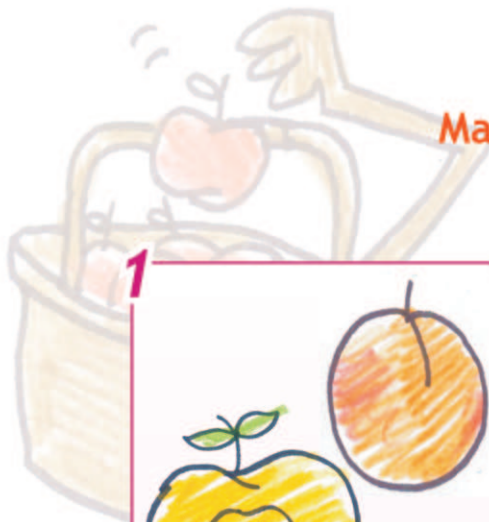


**4** Starts to have a smell

**5** Seed color may change



## Maturity in Apples and Pears



**1**

Seeds darken

**2**

Sugar content begins to increase

**3**

Firmness begins to decline

## T I P S

**1**

Apples and pears must be harvested before they are ripe to ensure good quality and shelf life



**2**

Fruit that is allowed to ripen on the tree may fall off (drops), be of poor firmness, and have limited market potential



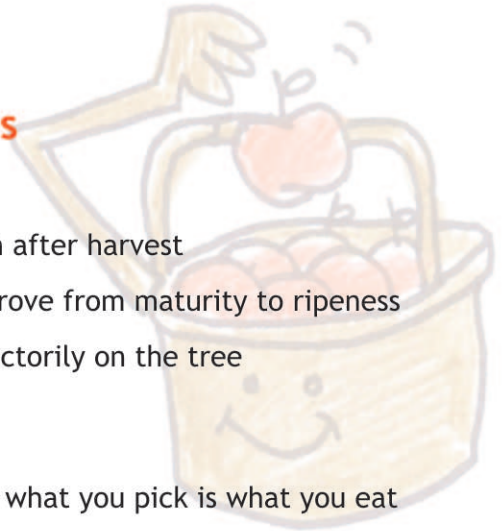
**3**

Pome fruits should be harvested as soon as maturity is reached





## Maturity in Stone Fruits



### Apples & Pears:



- Should be allowed to ripen after harvest
- Flavor and sweetness improve from maturity to ripeness
- Pears will not ripen satisfactorily on the tree

### Stone Fruits:



- Do not ripen off the tree - what you pick is what you eat
- Are allowed to ripen on the tree before harvest
- Do not become sweeter after harvest

### Harvest When

#### 1 Size and shape changes



Fruits become fuller and rounder as they mature

#### 2 Color Changes



Fruit lose the greenish color, reds, blues, and yellows become stronger

#### 3 Firmness



Fruits become softer as they begin to mature - we can test this with a penetrometer

#### 4 Sugar content



Sugar content becomes higher, we can taste this or measure with a brix meter



### TIP

Harvest when sugar levels are achieved

## How Is Quality Achieved

1



Good Management (During the year)

2



Good Harvest Practice

3



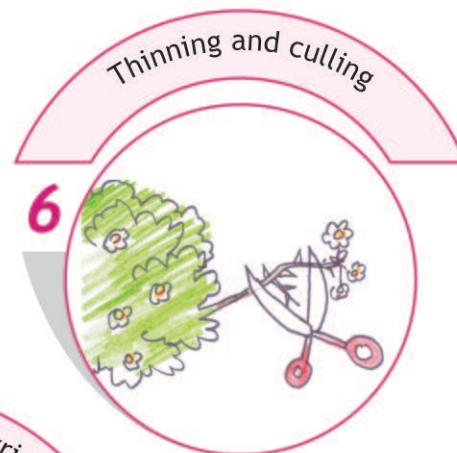
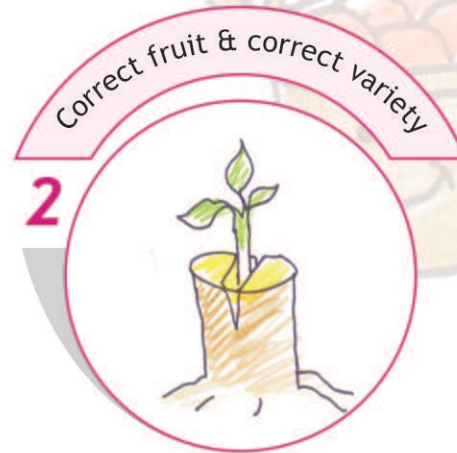
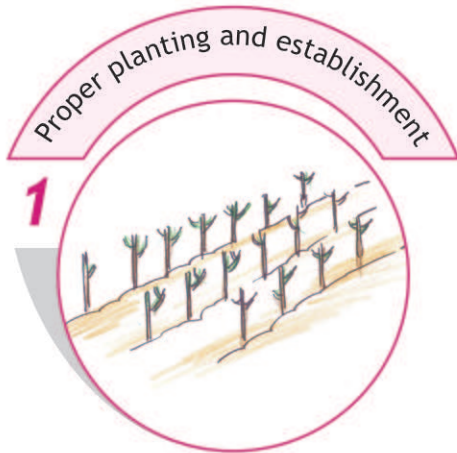
Good Post-Harvest Practice





## How Is Quality Achieved




A- By good management during the year





## Proper Harvest Practices

### When to Harvest

-  Maturity vs. ripe
-  Quality only deteriorates after maturity
-  Monitoring- brix, firmness, starch, and color

### How to Harvest



**1**  
1<sup>st</sup> Picking high grade (outer and southern) and culls

**2**  
2<sup>nd</sup> through 4<sup>th</sup> picking allows for maturity and further development



**3**  
Remove culls as soon as economically feasible

**4**  
Cleanup of orchard - drops, culls, damaged trees



### TIPs

- Field sort - skilled pickers
- Harvest one variety at a time



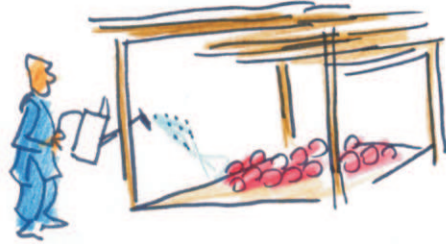
## Harvest Practices

1



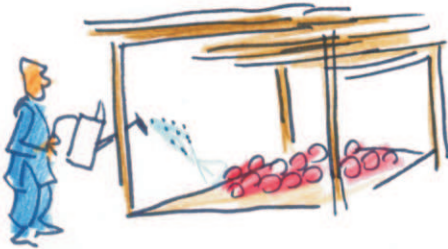
AM Harvest times

2



Shade promptly

3




Cool as soon as possible

4



Remove from the field quickly

5




Field pack versus shed pack

6



Don't harvest more than you can handle

7



Field Heat Discussion



## Harvest Equipment



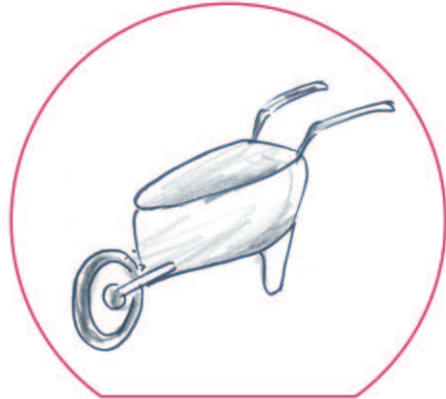
1 Soft bags



2 Large bins



3 Ladders



4 Trolley



5 Truck



### TIPS

Pre-sorting during harvest

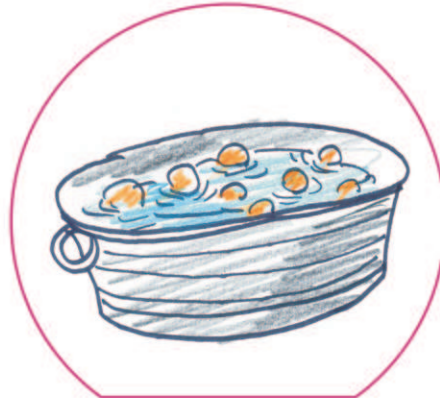
Careful handling



## Post-Harvest Practices



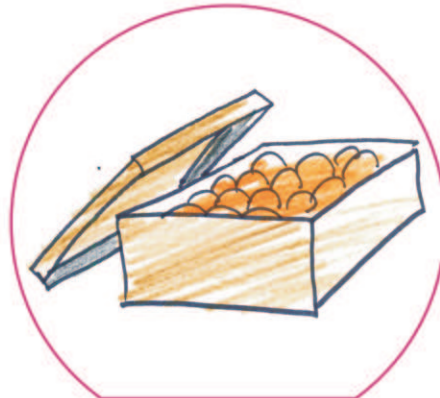
**1** Cooling



**2** Washing



**3** Sorting-Grading



**4** Packing



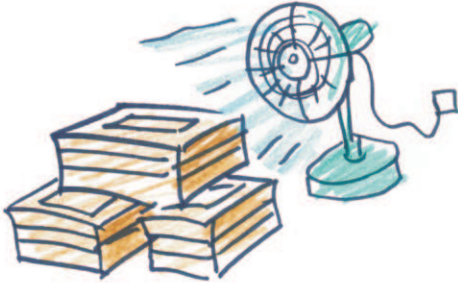
**5** Shipping



**6** Selling

## 1- Cooling Helps Maintain Quality

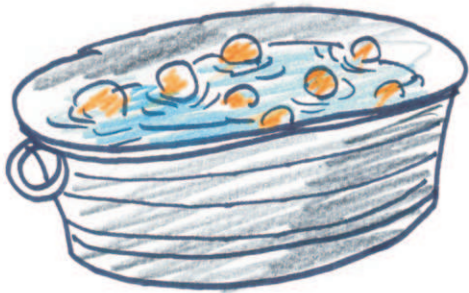
FORCED AIR COOLING



HYDRO-COOLING



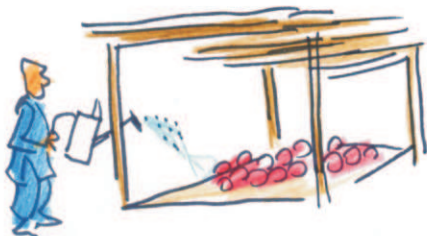
WATER BATH COOLING



COOL ROOM COOLING



SHADED STORAGE



AM PICKING





## 2- Washing Helps Maintain Fruit Quality

### T I P S

**1**

Clean drinking water should be used

**2**

Bleach or other FOOD GRADE disinfectants may be used to advantage

**3**



Wash water should be changed frequently

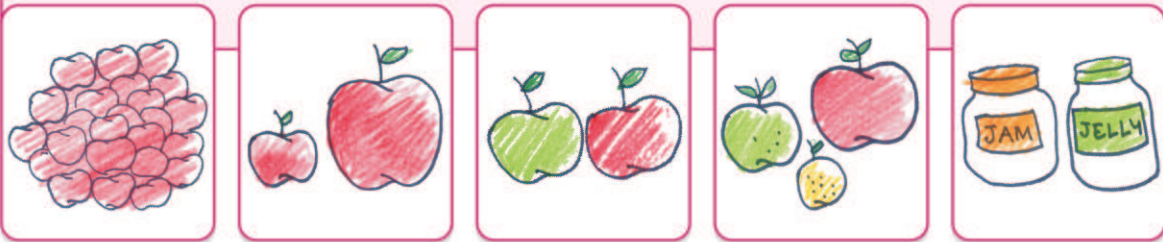


### 3- Sorting-Grading

#### Sorting-Grading ...



-  ...help maintain fruit quality & increases fruit value.
-  ...may target established grades




#### Grading

**1**




Define what a piece of fruit must be like to be the highest quality (often as what it can not be)

**2**



Define what a fruit must be like to be second best

**3**

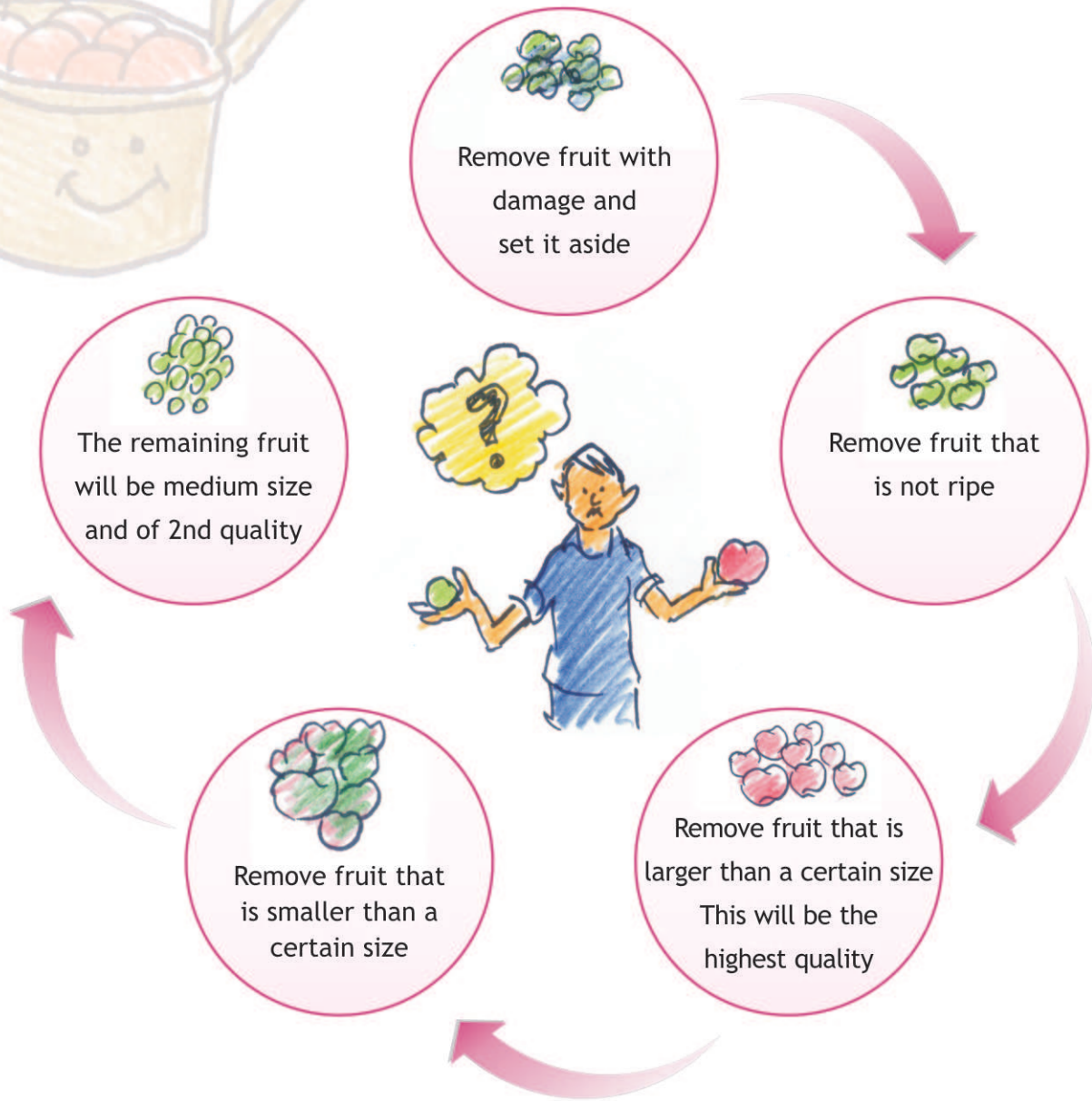


Sort the fruit to fit into these two classes and called the rest as third grade





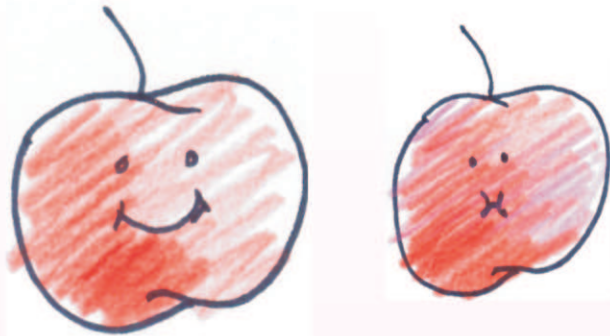
### Steps in Sorting



## 4- Packing Fruit

Packing fruit maintains quality and increases value

Use The Right Package



What quality of fruit



What buyer for the fruit



How to be transported to market



### TIPs

Do not overfill the box

Overfilling causes damage and spoilage

## 5- Shipping



**1**

Apples can be stored for 1 to 3 months under most scenarios if proper storage rooms are present

**2**

Pears can also be stored for 1 to 2 months

**3**

Stone fruits can not be stored under Pakistani conditions and should be shipped and marketed as soon as possible.

## 6- Selling

**1**

You must know your cost

**2**

You must know the value of your product

**3**

You must identify the buyer who will pay you a fair price

It takes time to develop a reputation as a quality producer.



## Harvesting Different Fruit Trees



Apple/ Pear  
Harvesting

1



Plum Harvesting

2



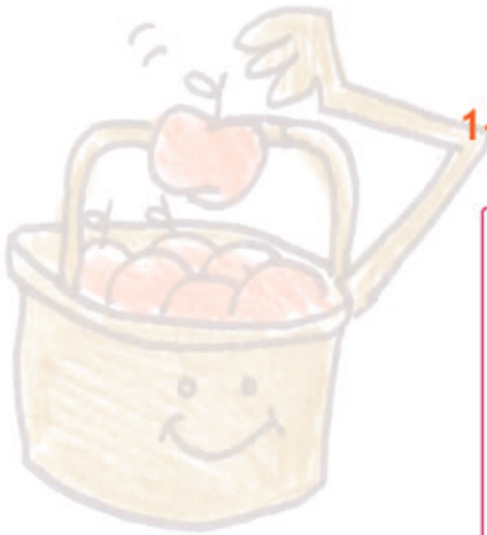
Apricot Harvesting

3

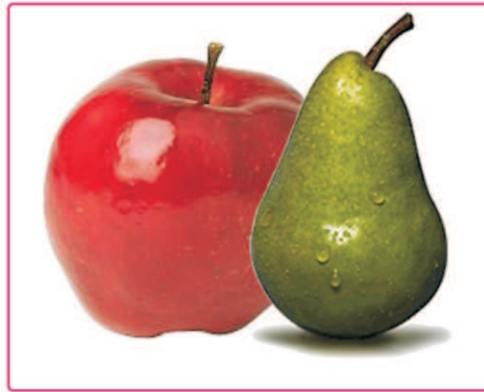


Peaches & Nectarines  
Harvesting

4



## 1- Apple/ Pear Harvesting



### Harvesting

- Hand-pick fruit into bags
- Transfer gently into field bins
- Shade fruit in bins.
- Transport to packing sheds
- Submerge the fruit in water, wash, and sort



### Packaging

- Packaging keeps the product
- Convenient units for handling
- Protects it during marketing
- Storage
- Easy to handle
- Protect the fruit
- Mechanical damage
- Allow for rapid cooling



### Storage

- Cool your apples as quickly as possible
- Keep them cool regardless of the time in storage.
- Optimal temperatures
- 30 to 32 degrees F.
- Fast at 40 degrees F than at 32 degrees F.
- Air-cooled or mechanically refrigerated.



## 2- Plum Harvesting



### Harvesting

- Prunes are hand-picked into bags
- Dumped into bins or containers
- Moved on trolleys from the orchard
- Plums are dumped
- Eliminate fruit with visual defects
- Fruit of high surface color to a high-quality pack
- Segregate fruit by size using either weight or diameter



### Handling

- Should be packed into smaller and shallower boxes
- Plums are much less resistant to bruising and pressure damage



### Storage

- Stone fruits have very limited storage potential and small producers are not advised to attempt this unless they have substantial experience.

### 3- Apricots Harvesting



#### Harvesting

- Processing are picked by hand and carefully handled.
- Trees are usually picked 2-3 times each
- Trunk shaking can be used for processed fruit,
- Suffer more from shaking than other stone fruits.



#### Handling

- Handpicked into bags or buckets
- Dumped into larger containers
- Shipped in shallow containers to prevent crushing/ bruising.



#### Storage

- Short shelf-life of only 1-2 weeks at 0° C and 90% relative humidity
- Susceptible to many fruit rots the same as other stone fruits.

## 4- Peaches & Nectarines Harvesting



### Harvesting

- Picked by hand and carefully handled
- Trees are usually picked 2-3
- When fruit are firm



### Handling

- Handpicked into bags or buckets
- Carefully dumped into larger
- Sorting and packing
- Packed in layers in shallow cartons or in trays
- Can not withstand poor handling

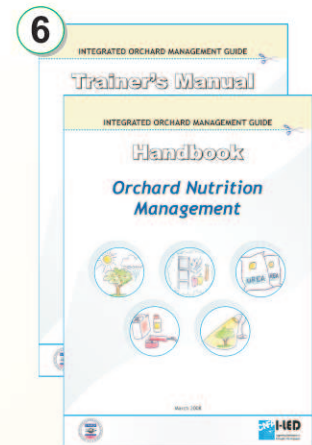
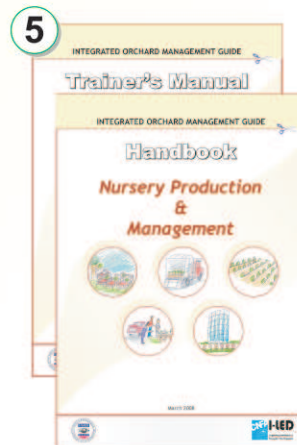
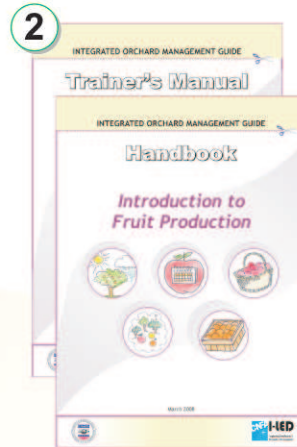


### Storage

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# INTEGRATED ORCHARD MANAGEMENT GUIDE



ECI (Pvt.) Ltd.

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