An Opportunity Which Transformed an Industry



AGENTS OF CHANGE, 02-04 December, Islamabad

Dr. A. U. Malik
Professor and Director Horticulture
University of Agriculture, Faisalabad

Background

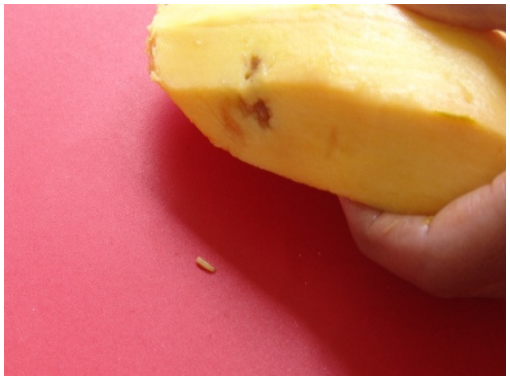
- Rural background
- Deep desire of studying oversees
- Huge Loss vs Lifetime opportunity
- Inspiration of Australian industry
- Passion for contribution - national development
- Dream-establishing a modern postharvest lab, training human resource, helping local industry development
- ASLP, USAID, UNIDO, PESP, HEC, PARB, INDUSTRY Projects
- Transformation of Industry (10-12 years)
- Journey continues, new goals

Which of these mangoes will have more value in the market?

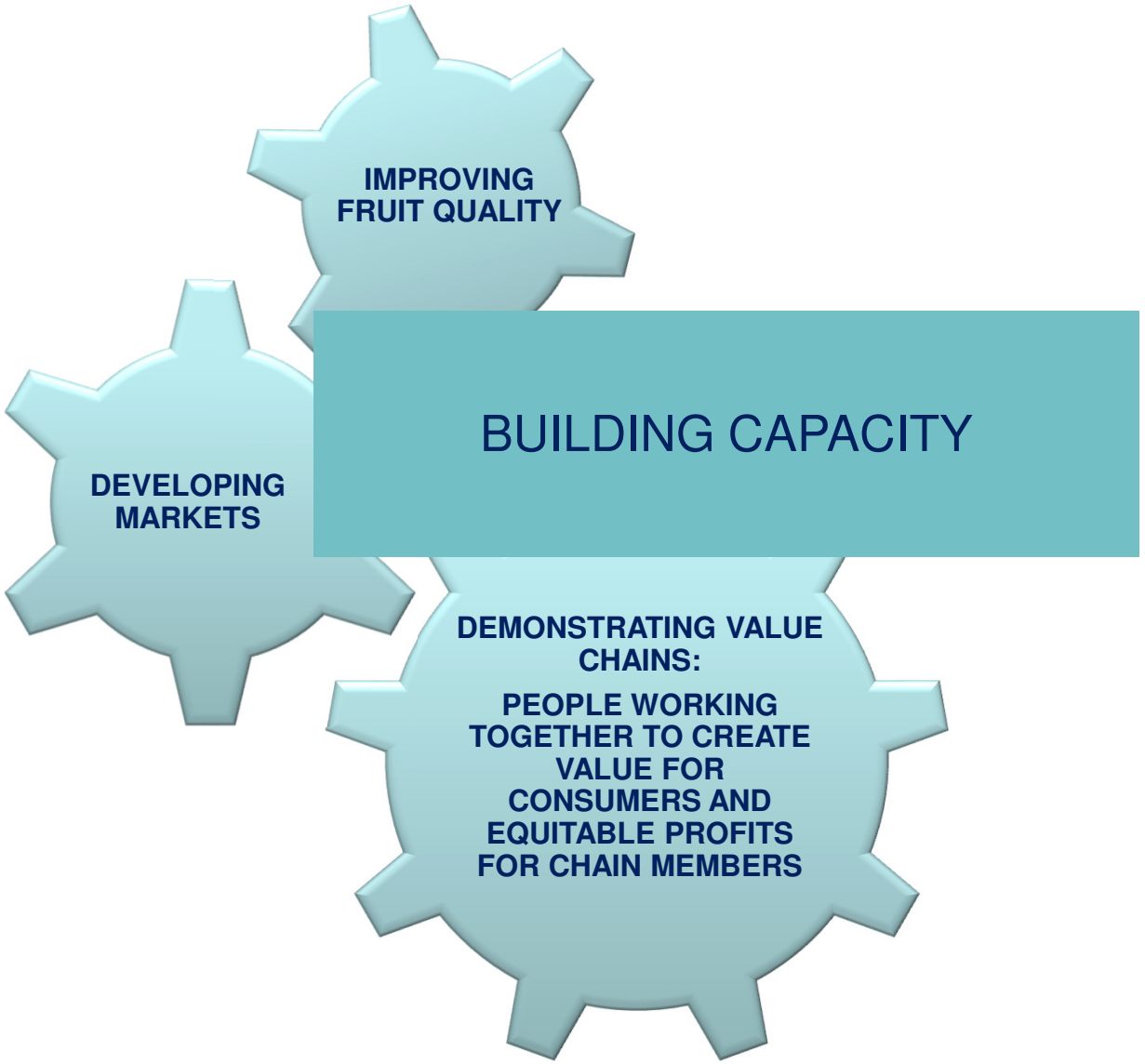
Quality is the combination of a product's attributes that are critical to meet customers expectations and needs.

What is often observed (Key Issues)

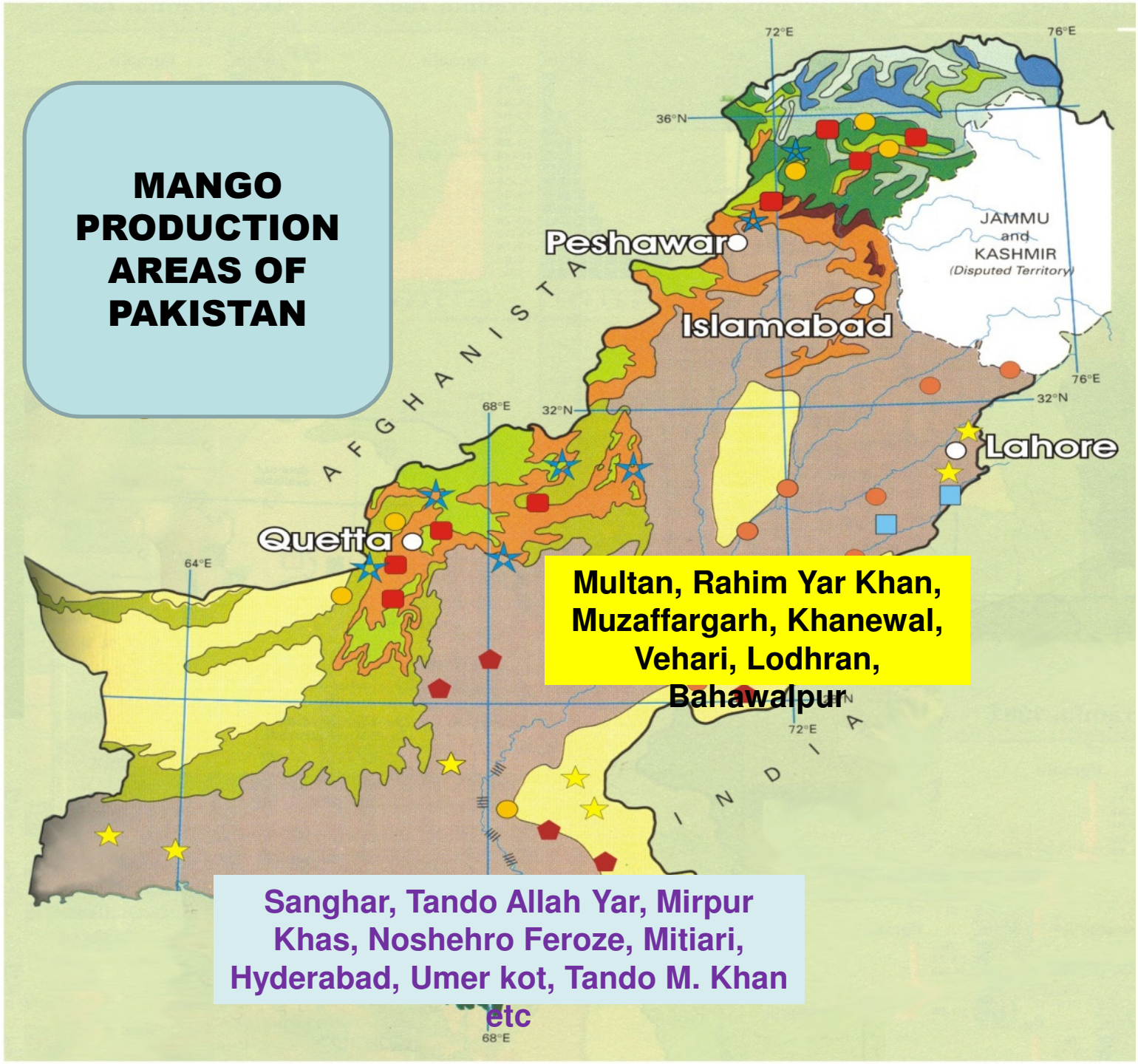
- Sapburn injury
- Fruit skin blemishes
- Disease breakout
- Fruit fly
- Poor peel colour development
- Inferior packaging



ASLP project integrates across four focus areas



MANGO PRODUCTION AREAS OF PAKISTAN



Walking the Chain Activities

(Australian Mango Industry Supply Chain Visit, January 2007)

Training of Researchers

Documenting Supply Chain

Documentation of Supply Chain Handling Practices

Project R&D Work at Postharvest Lab

Developing Physical De-sapping Techniques

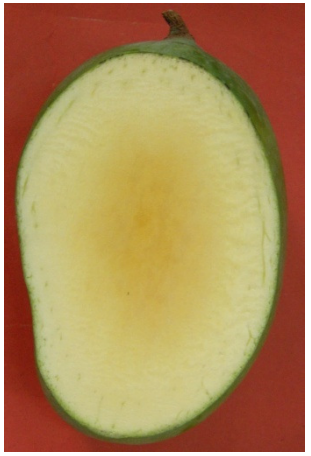
Sap Characterization

Project R&D Work at Postharvest Lab


07.07.2009


Thermoline


Mature: Ready to Harvest
Keep cut surface of mango fruit under hole to compare pulp colour.
cv. Samar Bahisht Chaunsa
cv. Sindhri



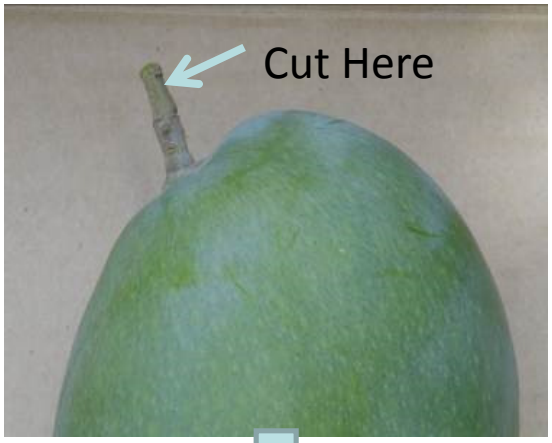

Brix
SUCROSE
20°C
AUTOMATIC
30
25
20
15
10
5
0
ATAGO

Sapburn Management Methods

Physical desapping

Lime wash

Short stemming



Improved harvest and desapping techniques

1. Harvesting along with 4-6 inches long pedicel

2. Desapping in 0.5% lime solution (2-3 min dip)

3. Washing in clean water

Improved harvest practices

Postharvest handling Care



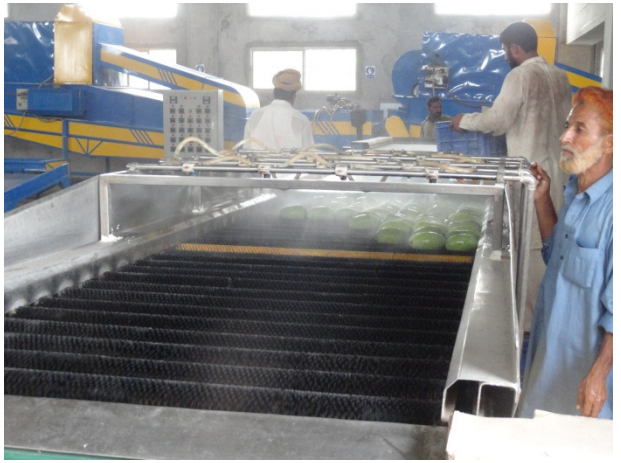








USAID
FROM THE AMERICAN PEOPLE



New Generation Ethylene Generator
Koldware-UAF Collaboration

Made in Pakistan: Koldware Industries, Karachi

Workshops


Sea-Freight Shipments

Sea-Freight Consignment Preparations under Team Supervision



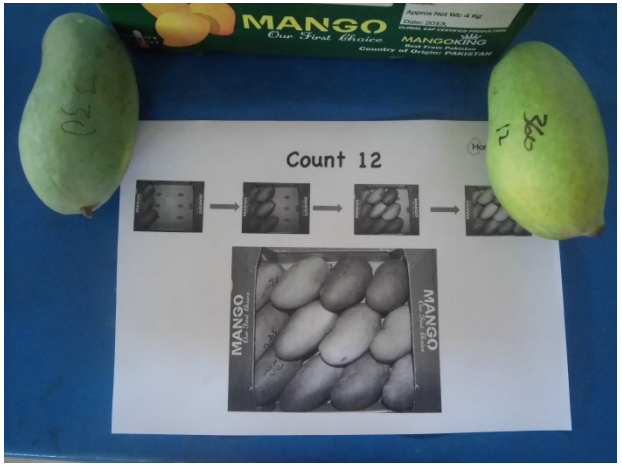











MANGO
Our First Choice
Count 12


MANGO


MANGO


MANGO


MANGO


MANGO

Sea-Freight Trials (Sindhri)

Sindhri (Protocol)
Commercially tested for EU with SMG

- *Harvesting & desapping*
- *Processing and Hot fungicide dip (52°C-3min)*
- *Grading & packaging (single layer; open top boxes)*
- *Precooling and shipping at 12°C*





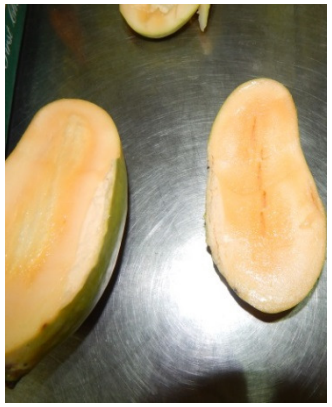
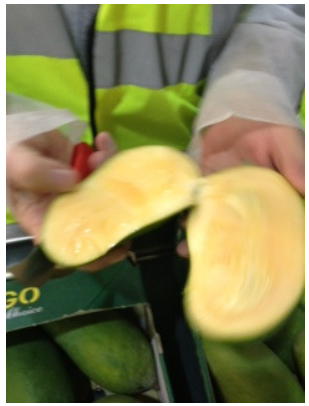



- Excellent quality at retail
- Importer was much satisfied

Physical Appearance of fruit on arrival in UK
(30 days after dispatch from SMG farm)





Sea-freighted Sindhri mangoes being sold at Tesco stores in UK

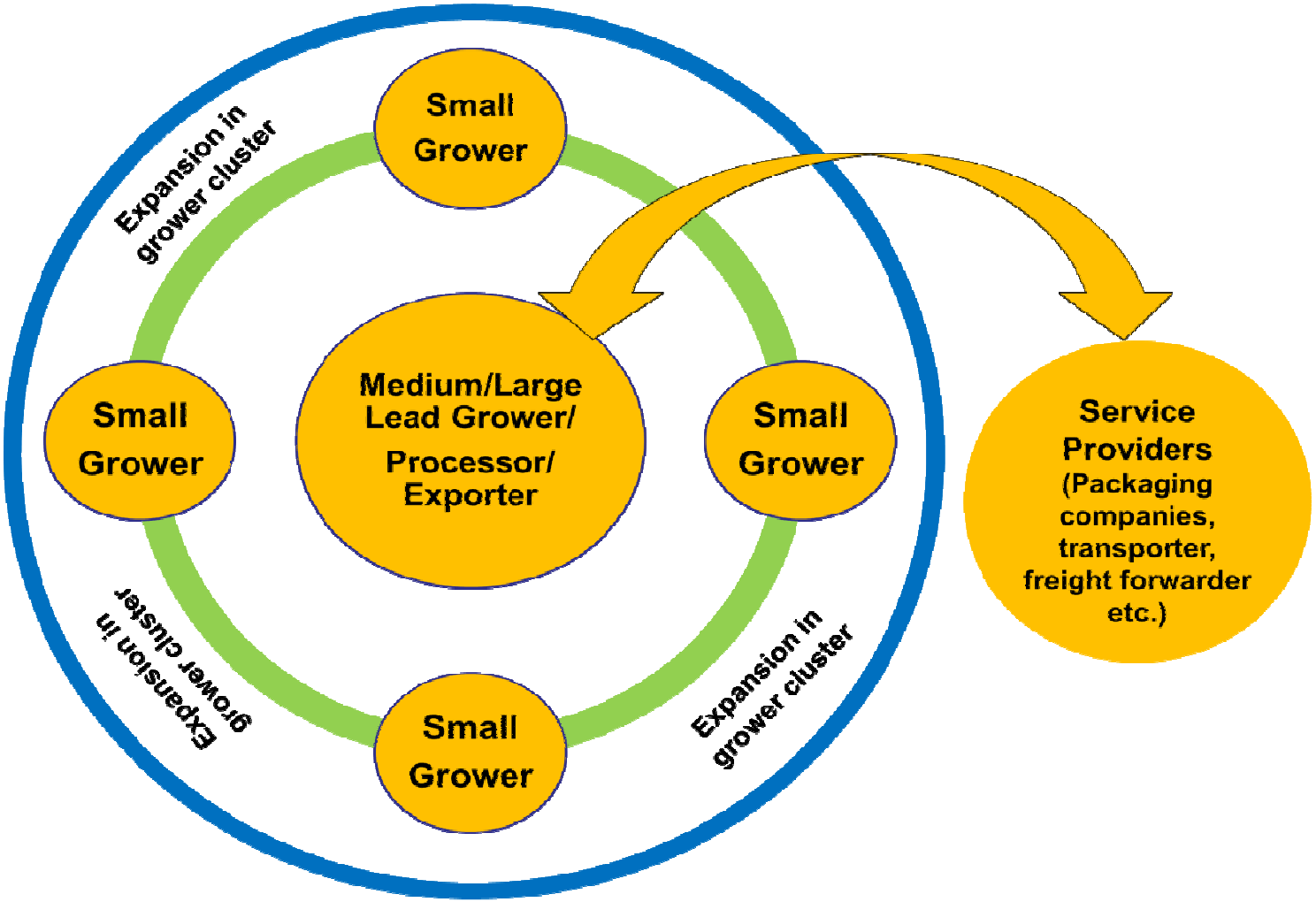
Brief Protocol for Sea-Freight of Sindhri

- **Harvest** (Early 2nd week of June)
  (Intact pedicels; TSS = 6.0-6.3 °Brix)
- **De-sapping, Sorting & Processing**
  Physical/Lime de-sapping, washing,
  Fungicidal dip (52 °C- 5min)
- **Sorting/Grading/Packaging**
- **Palletizing**
  (Open top boxes; 16-18 layers)
- **Precooling** (12~14 °C; 10-12 hrs)
  & Container Loading
- **Sea-Port Delivery**
  (24 hrs before cut-off time)
- **Shipment** (26-30 days)
  (4%CO2; 1.5%O2; 12 °C; 85-90%RH)
- **Conditioning & Ripening at Destination** (24 °C)

Orchard selection: Key

Activity	Required duration
Preparation & cooling	3 days for 40ft container
Shipping time to EU/UK	24-26 days
Custom Clearance (at dispatch & destination)	2-3 days
Shelflife required at destination	7-10 days
Total	**36-42 days *(35+ days)***

EU/UNIDO funded TRTA-II COPs Project



4+1 Cluster Model


Value Added Products
Development

Developing markets: Value-added product research

SAU team members have completed one season of pilot scale development of value added mango products


Export Market
Research

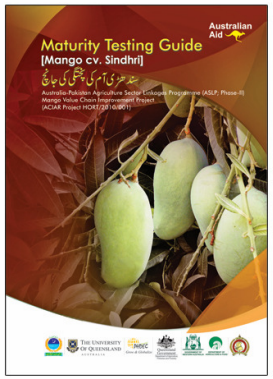
Domestic and Export Market Research

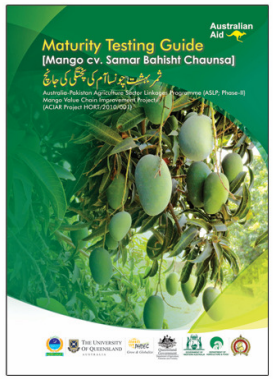
Developing markets: UK market research

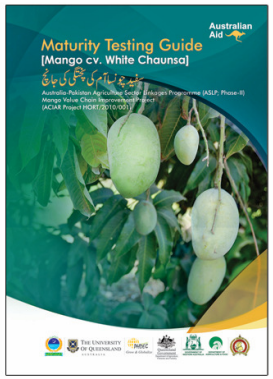
- **Mangoes are a minor product**
- **Predominance of Florida varieties from east Africa**
- **Retail shelf life: 4 days**
- **Fruit size – 400-500gms**
- **Sold individually or in 2 pack**
- **ready to eat – '*Perfectly Ripe*'**
- **Price range £1-£1.50/piece**

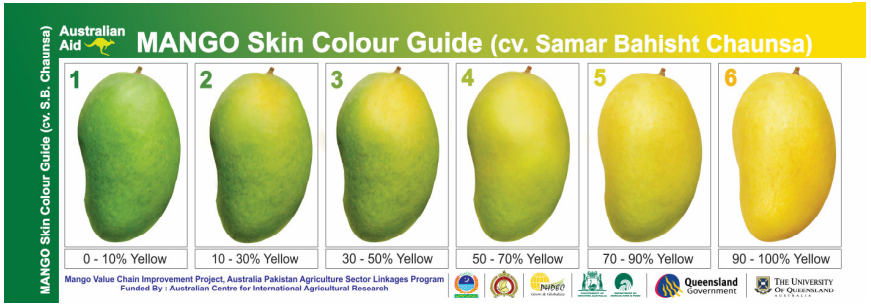

Publications

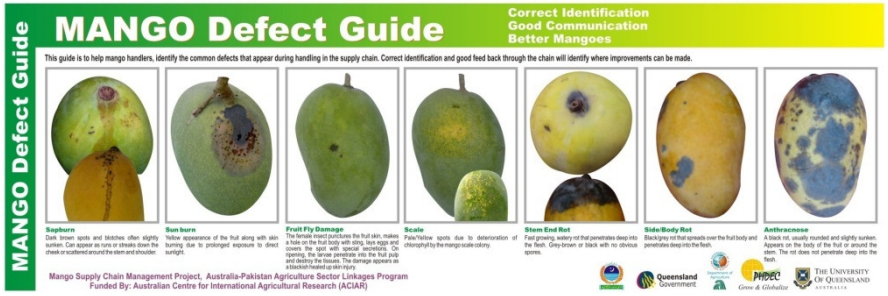
Production of technical guides and manual

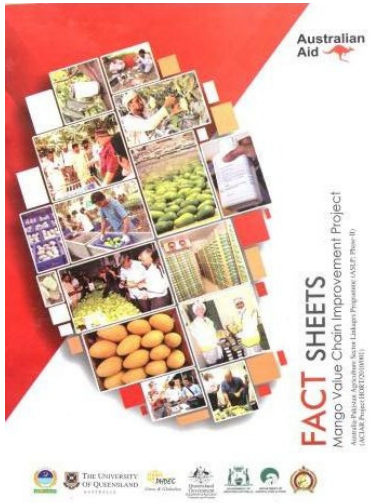


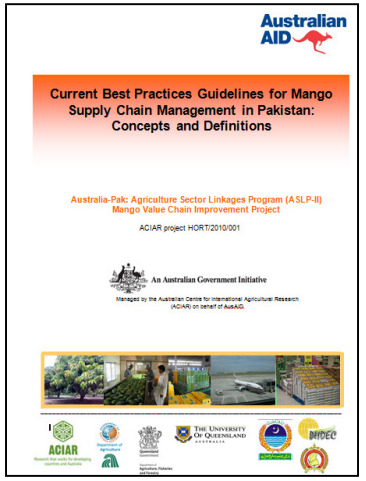




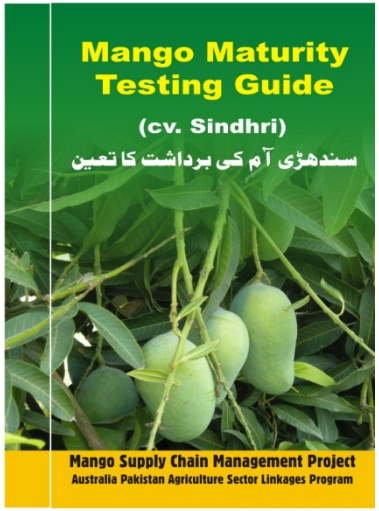


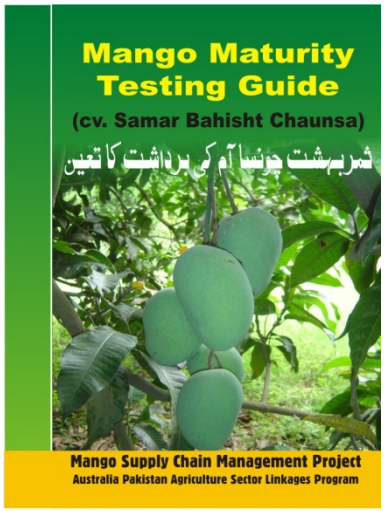






Guides/Posters/Trainings





8.50"

11.00"

MANGO Ripening Guide

(cv. Sindhri)

Ripen mature fruit

- Fruit must be mature to ripen properly (refer maturity guide) but must be maintained at hard green before commencing ripening.
- Immature fruit will soften slowly with wrinkled skin, poor colour (green) and flavour.

Cool or heat fruit between 20 and 22°C

- Use forced air cooling or air stack trays to precool or heat, mature hard green fruit and maintain pulp temperature between 20 and 22°C.
- Make sure fruit is above 20°C or below 22°C before introducing ethylene.

Set room temperature at 20°C

- Temperatures above 22°C during ripening increases rots, skin blemishes and green skin colour at ripe.
- Temperatures below 18°C during ripening increases acidity, rots and green skin colour at ripe.

Set ethylene concentration

Trickle systems:	10ppm continuous ethylene
Shot systems:	100ppm every 6 to 8 hours

Expose fruit to ethylene for two to three days

Maintain room humidity

- Design rooms to operate above 85% relative humidity

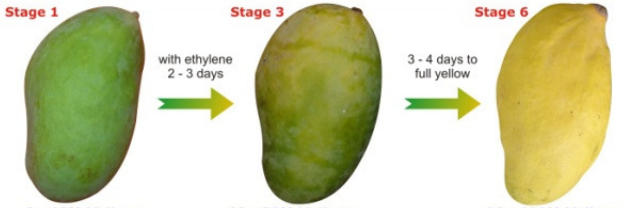
Vent rooms regularly

Vent rooms to prevent carbon dioxide build up. High levels affect skin colour and flavour.

- Trickle systems: Vent rooms continuously to allow at least one room volume change every hour.
- Shot systems: Vent rooms by opening doors for at least 10 minutes every 6 to 8 hours (just before ethylene injection).

Hold fruit at 20°C until it reaches the right ripeness level

Hold fruit at 20°C until it reaches the right ripeness level specified by the customer. Precool to 12°C for long distant markets (trip over 24 hours).



Queensland Government · Department of Agriculture · PHDEC Grow & Globalize · The University Of Queensland Australia

Mango Supply Chain Management Project, Australia-Pakistan Agriculture Sector Linkages Program
Funded By: Australian Centre for International Agricultural Research (ACIAR)

MANGO Fruit Quality: Major Concerns

Sap Burn

Sap is an acidic and sticky liquid which oozes out of the fruit when it is harvested with broken pedicel. It causes serious skin damages symptomizing as brownish black streaks or blotches over the fruit skin, resulting in poor cosmetic fruit quality and lower marketing grade.

Causes:

Improper harvest techniques and handling procedures

Management:

Harvest the fruit with 4-6 cm pedicel and then adopt one of the following methods:

- Destem above first knuckle (flush node), leaving small stalk intact with fruit.
- Cut back pedicel below knuckle with secateur leaving 1 cm stalk and keep fruit in inverted position over a proper desapping frame for 30 minutes.
- Cut back pedicel with secateur leaving 1 cm stalk and immediately dip in lime solution or break the whole pedicel while dipping fruit inside the lime solution (5 gram/litre or 0.5kg/100litre). Keep fruit dipped for 2 minutes followed by washing in clean (preferably chlorinated) water

Stem End Rot (SER)

Stem end rot is one of the major fungal diseases prevailing in mango orchards. The inoculum penetrates in the fruit from the orchard and starts growing when it finds suitable conditions of humidity and temperature. A dark brown, soft decay starts at the stem end and rapidly rots the whole fruit.

Causes:

SER is caused by a number of fungal organisms including *Dothiorella dominicana*, *Phomopsis mangiferae* and *Botryodiplodia* spp. etc. Irrigation stress and dry weather conditions during fruit development and presence of dead/ diseased plant parts enhance SER incidence.

Management:

Preharvest:

Good agricultural practices, removal of dead/diseased plant parts, orchard sanitation and appropriate sprays. Avoid drought stress during fruit growth period.

Postharvest:

- Process and precool fruit within 24 hours after harvest.
- Temperature management throughout the supply chain.
- Hot water treatment (with and without fungicide) at 52ºC for 5 minutes.

For further information, please consult ASLP Best Practice Mango Supply Chain Management Manual

Fruit Fly

Fruit fly is a major quarantine issue and Pakistani mangoes export is restricted in various markets including China, Iran, Japan and USA due to prevalence of fruit fly in mango growing areas. Attacked fruits usually show signs of ovipositor punctures. The whole of the infected fruit is badly damaged by larvae and deteriorates internally.

Causes:

Bactrocera zonata and *Bactrocera dorsalis* are the two major fruit fly species prevailing in Pakistan. Fruit fly lays eggs inside the fruit surface when fruit is at hard green stage. The larval activity results in breakdown/degradation of pulp tissues.

Management:

Preharvest:

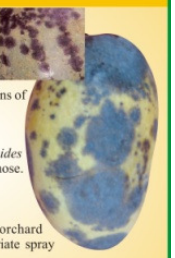
Good agricultural practices (GAP) and orchard sanitation combined with the integrated pest management (pheromone traps, protein baits, appropriate chemical sprays, and biological control etc.)

Postharvest:

Fruit fly hot water disinfestation treatment as per requirement of the importing country Irradiation, Vapour heat treatment etc.

Anthracnose

Mango anthracnose is a fungal disease which appears on the fruit surface as rounded brown to black lesions with indefinite borders. Fungal inoculums inhibits from the orchard and starts growing when it finds suitable conditions of humidity and temperature.



Causes:

A fungus *Colletotrichum gloeosporioides* is responsible to cause mango anthracnose.

Management:

Preharvest:

Good agricultural practices and orchard sanitation combined with the appropriate spray program.

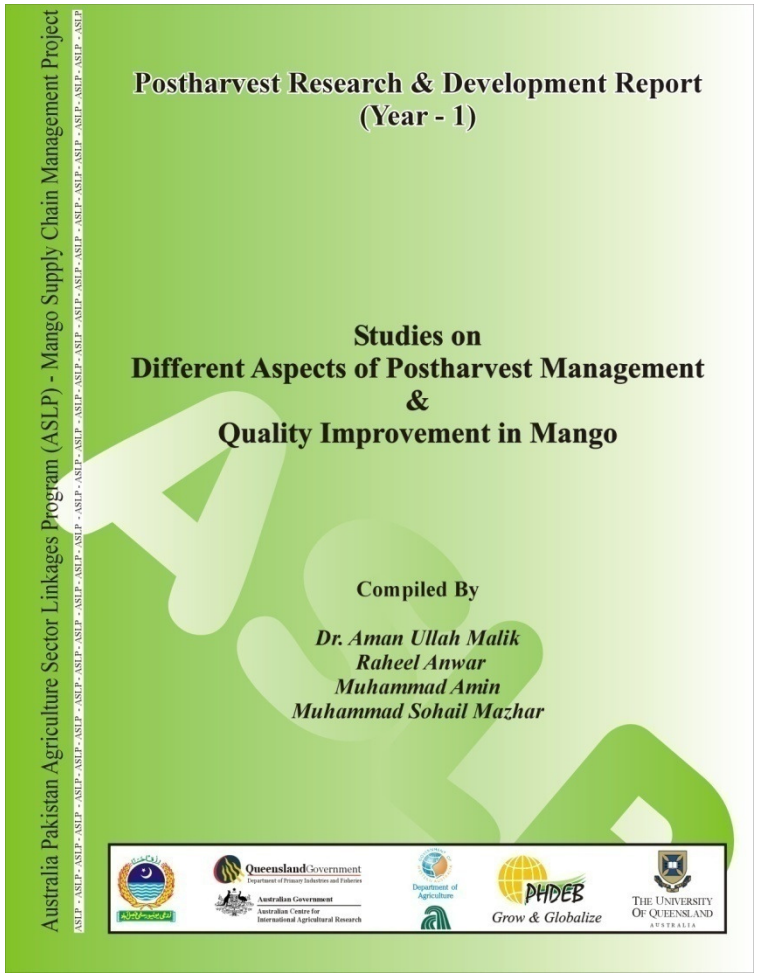
Postharvest:

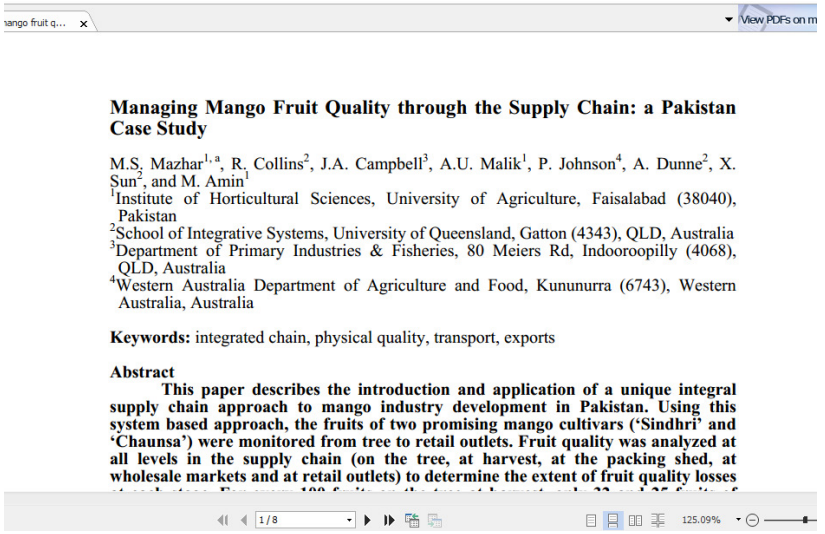
- Fungicidal treatment within 24 hours after harvest
- Temperature management throughout the supply chain.

Mango Supply Chain Management Project,
Australia-Pakistan Agriculture Sector Linkages Program
Funded By: Australian Centre for International Agricultural Research

Queensland Government · Department of Agriculture · PHDEC Grow & Globalize · The University Of Queensland Australia

Reports/Research Papers





Managing Mango Fruit Quality through the Supply Chain: a Pakistan Case Study

M.S. Mazhar[1, a], R. Collins[2], J.A. Campbell[3], A.U. Malik[1], P. Johnson[4], A. Dunne[2], X. Sun[2], and M. Amin[1]
[1]Institute of Horticultural Sciences, University of Agriculture, Faisalabad (38040), Pakistan
[2]School of Integrative Systems, University of Queensland, Gatton (4343), QLD, Australia
[3]Department of Primary Industries & Fisheries, 80 Meiers Rd, Indooroopilly (4068), QLD, Australia
[4]Western Australia Department of Agriculture and Food, Kununurra (6743), Western Australia, Australia

Keywords: integrated chain, physical quality, transport, exports

Abstract

This paper describes the introduction and application of a unique integral supply chain approach to mango industry development in Pakistan. Using this system based approach, the fruits of two promising mango cultivars ('Sindhri' and 'Chaunsa') were monitored from tree to retail outlets. Fruit quality was analyzed at all levels in the supply chain (on the tree, at harvest, at the packing shed, at wholesale markets and at retail outlets) to determine the extent of fruit quality losses

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Full Length Article

Improved Harvest and Desapping Practices Affect Mango Fruit Quality along the Supply Chains

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‡Western Australia Department of Agriculture and Food, Kununurra, Western Australia
[1]Corresponding author's e-mail: malikaman1@gmail.com

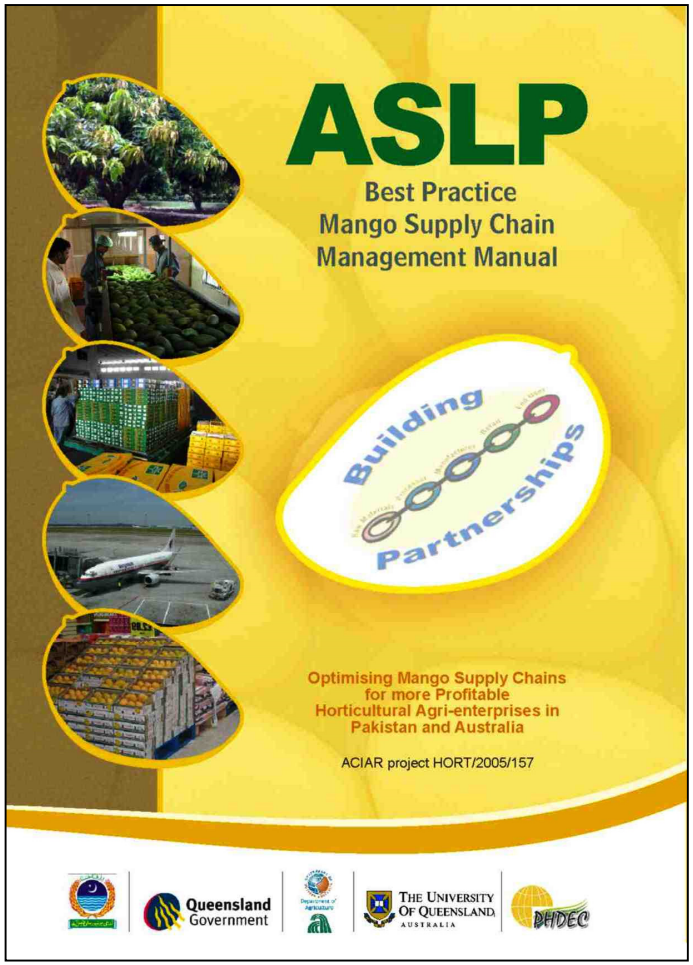
ABSTRACT

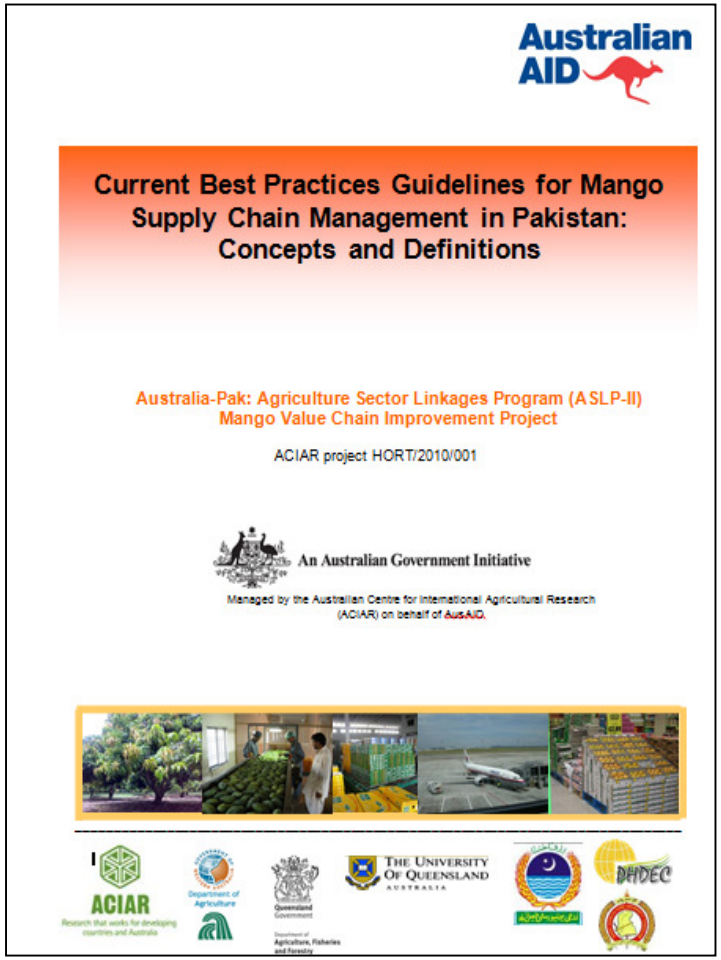
This study was aimed at evaluating the impact of improved harvest and handling practices including careful fruit harvesting along with 4-6 inches long pedicels, de-stemming and de-sapping in 0.5% lime solution, 2-3 min dip and washing in tap water, on the fruit quality of mango along domestic supply chains in Pakistan compared with traditional harvest and handling system prevailing in local mango industry. Six domestic supply chains in two mango cultivars Sindhri and Samar Bahisht Chaunsa were monitored in this regard. The impact assessments were made on the basis of performance against sap burn, skin browning, lenticels spots, rots and physical damage. The effect on fruit skin color and firmness was also studied. Significant interaction of skin browning, sapburn injury, rots and physical damage was found with the practices adopted at farm level. These problems were found to start from farm (origin) and significantly increase along the supply chains depending upon the

General Output

5. Industry Guidelines

- ASLP Best Practices Manual (With ACIAR)
- ASLP Best Practices Primer





Postgraduate student presenting paper at International conference

- Work presented at 7th International Postharvest Symposium, Malaysia during June, 2012

- Acknowledgement: ACIAR- Capability Fund

Aman Ullah Malik

PhD

Professor (Horticulture/Postharvest)

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20.14

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Capacity Building

Activity 3.1

Small Scale Packhouse Trainings in Collaboration with UNIDO

Seminars at UAF

Peter Hofman delivering lecture on Integrated approach for mango quality management (Participants: 30 Males, 11 Females)

Tim Sun delivering lecture on value chain management principles and their application in Pakistan mango industry (Participants: 32 Males, 13 Females)

Demonstrating value chains: sea freight to the Middle East static simulation trial

Static container simulation on-farm using SB Chaunsa. <u>Positive results</u>

Followed by workshop to discuss results and protocols with growers, exporters, extension agents and researchers.

- avoided potentially costly commercial error in 2013
- live trials in 2014 co-funded by industry.

Farmer & Worker Trainings/Coaching Programs

Building capacity: Women's training

A 12 day workshop at SAU for 30 village women, focused on developing the skills to produce and market value added mango products

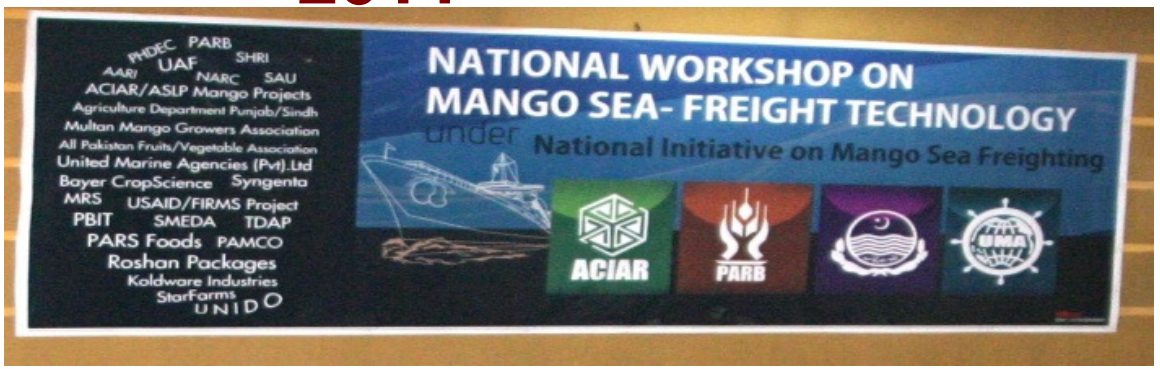
Workshop on Sea-Freight Technology, 2011

Participants

- Growers
- Contractors
- Exporters
- Freight forwarders
- Inland logistic services
- Shipping companies
- Certification agents
- Packaging companies
- Pesticide companies
- Other related organizations

No. of participants =

More than 100 (incl. more than 10 females)



ASLP Stakeholders' Workshops

Four (Pre & Post Season) workshop conducted in Sindh and Punjab

National/International Visitors Visited PRTC

National/International Visitors Visited PRTC

National/International Visitors Visited PRTC

National/International Visitors Visited PRTC

National/International Visitors Visited PRTC

National/International Visitors Visited PRTC

Postharvest R&D Capacity Developed out of ASLP

Maturity Protocols Colour Development/ Ripening



Amin, Hafiz Umar, Hassan A. Butt and Omer Malik

Orchard Rating Studies


Zohaib Ali

M. Fiaz

Maturity Assessments

Farrukh Azeem

Postharvest Disease Management



Sana, Amber, Habat and Waqar

Irradiation Studies

M. Umar


Cold Storage Facility

Reefer Van


CA Facility

Stereo-microscope


UV Spectrophotometer


Gas Chromatograph

Postharvest Journey Over Time

2007

Postharvest and Medicinal Plants Lab

2011

Postharvest Research and Training Centre

2016: Journey continues, with new goals

Postharvest as a major subject at B.Sc (Hons) level

Fulbright Experience

Partnerships-Sister Universities of World Food Reservation Centre

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