Issues and Advances in Postharvest Disease Management of Mango under Pak-Australia Agri. Sector Linkages Program: Mango Supply/Value Chain Management Projects

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Top Ten Mango Producing & Exporting Countries in the World

<table>
<thead>
<tr>
<th>Production ('000' Tons)</th>
<th>Export Quantity ('000' Tons)</th>
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<tbody>
<tr>
<td>India</td>
<td>India</td>
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<tr>
<td>China</td>
<td>Mexico</td>
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<tr>
<td>Thailand</td>
<td>Brazil</td>
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<tr>
<td>Indonesia</td>
<td>Netherlands</td>
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<tr>
<td>Mexico</td>
<td>Peru</td>
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<tr>
<td>Pakistan</td>
<td>Peru</td>
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<tr>
<td>Brazil</td>
<td>Ecuador</td>
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<td>Philippines</td>
<td>Thailand</td>
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<tr>
<td>Bangladesh</td>
<td>Guatemala</td>
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<td>Nigeria</td>
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(FAOSTAT, 2008)
Pakistan Mango Industry Outlook

Area ('000' Ha)

Production ('000' Tonnes)

(MinFA, 2010)
Pakistan Mango Industry Outlook (Cont’d)

- Mainly grown in two provinces (Sindh and Punjab)
- Important Mango Cultivars
  - *Sindhri
  - *Samar Bahisht Chaunsa
  - Sufaid Chaunsa
  - Kala Chaunsa
  - Dusehri
  - Anwar Ratole
  - Langra

*Samar Bahisht Chaunsa and Sindhri are major export varieties
General Quality Issues in Mango

- Variation in Fruit Quality
- Limited Shelflife
- Postharvest diseases
- No scientific data available on local cvs for harvest & handling
Major Postharvest Pathological Issues

- **Anthracnose**
- **Body Rots**
  - Stem End Rot (SER)
  - Side Rot
Unit export value (US$/Ton) of top ten mango exporting countries

(FAOSTAT, 2008)
Major Factors associated with disease development

- **Environmental Factors**
  - **Abiotic**
    - Temperature
    - Humidity
    - Soil
  - **Biotic**
    - Vector pests population
    - Pathogen occurrence/inoculums level

- **Tree Factors**
  - Tree health
  - Fruit maturity level at harvest

- **Harvest & Handling Factors**
  - Harvest techniques (Sap)
  - Postharvest treatments
  - Handling conditions
    - a) Temperature
    - b) Relative Humidity
    - c) Packaging
ASLP Projects
(Funding Agency: Australian Centre for International Agricultural Research-ACIAR)

Phase-I: Mango Supply Chain Management Project
(2007-10)

Phase-II: Mango Value Chain Improvement Project
(2011-15)
Main Objective

To address key constraints currently limiting the competitiveness of supply/value chains for Pakistani mangoes
Establishment of Postharvest Laboratory at UAF (2007)

Postharvest Lab was upgraded to Postharvest Research and Training Centre (PRTC) during March, 2011
Progress made regarding Pathological Issues under the Project

1. Evaluating the extent of different diseases at postharvest level

2. Monitoring the losses caused by diseases in domestic and international/commercial supply chains

3. Identification of pathogens associated with fruit body rots

4. Management strategies for postharvest diseases in mango
   - Precooling
   - Hot water treatment
   - Pre & Postharvest fungicidal applications
   - In vitro studies
1. Extent of different postharvest diseases in mango

Disease ratings: 0 = Nil, 1 = 5-10%, 2 = 10-25%, 3 = >25% (P ≤ 0.05)
2. Monitoring of PH losses caused in domestic and commercial supply chains
a) Domestic Supply Chains

1. HYD-Sargodha: (cv. Sindhri)
2. Multan-Karachi (cv. Chaunsa)

Percentage of Different Categories of Chaunsa Mangoes at Retail Stores in Karachi

- Blemishes: 43%
- Rots: 28%
- Normal: 29%
Status of Postharvest Disease Development in Domestic Supply Chains

At Farm

At Retail
b) Commercial Consignments

1. Pakistan- Singapore (cv. Sindhri)
2. Pakistan- UK (cv. SB Chaunsa)

Percentage of Different Categories of Air Freighted Chaunsa Mangoes at Retail Stores in UK

- Blemishes, 38
- Normal, 50
- Rots, 12
3. Pakistan- Dubai (cv. SB Chaunsa)

As a result, sales were poor and returns were low.
3. Pathogens isolated from SER infected fruits

<table>
<thead>
<tr>
<th>Isolated pathogens/microbes</th>
<th>Frequency (%)</th>
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<tbody>
<tr>
<td></td>
<td>Sindhri</td>
<td>S.B. Chaunsa</td>
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<tr>
<td><strong>Primary Pathogens</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alternaria alternata</strong></td>
<td>49.27b</td>
<td>58.50a</td>
<td></td>
</tr>
<tr>
<td><strong>Phomopsis mangiferae</strong></td>
<td>19.97d</td>
<td>18.23d</td>
<td></td>
</tr>
<tr>
<td><strong>Botryodiplodia Spp.</strong></td>
<td>3.93e</td>
<td>2.73e</td>
<td></td>
</tr>
<tr>
<td><strong>Secondary Pathogens</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (Aspergillus sp., Penecillium sp., Xanthomonas sp. etc.)</td>
<td>26.80c</td>
<td>20.63d</td>
<td></td>
</tr>
</tbody>
</table>
Phomopsis, Botryodiplodia & Alternaria alternata isolated from rotten mango tissues
4. Management Strategies

a) Impact of precooling on postharvest disease development (cv. Sufaid Chaunsa)

Disease ratings: 0 = Nil, 1 = 5-10%, 2 = 10-25%, 3 = >25% ($P \leq 0.05$)
Precooled

Non-Precooled
4. Management Strategies

b) Impact of hot water treatment on postharvest disease development in mangoes (cv. SB Chaunsa)

Disease ratings: 0= Nill, 1= 5-10%, 2= 10-25%, 3= >25% (P≤0.05)
HWT
(52°C; 5 min dip)

2000ppm Tecto in HW
(52°C, 5 min dip)
4. Management Strategies

  c) Impact of pre and postharvest fungicidal applications (cv. SB Chaunsa)

\[ T_1 = \text{Control (no fungicidal application)} \]
\[ T_2 = \text{Carbendazim (@ 450mg/L)} \]
\[ T_3 = \text{TECTO (@1.8ml/L) A.I. Thiabendazole (TBZ)} \]
\[ T_4 = \text{Sportak (0.5 ml/L) A.I. Prochloraz} \]
\[ T_5 = \text{TECTO (@1.8ml/L) + Sportak (0.5 ml/L)} \]
**Preharvest Application**

- On tree application (15 days prior to harvest)
- Harvesting
- Grading, Packing, Precooling (10°C) and transport to PRTC
- Storage (12°C; 80-85%RH) for 21 days
- Ripening (30°C, 50-60%RH)

**Postharvest Application**

- Harvesting
- Grading, Packing, Precooling (10°C) and transport to PRTC
- HW Fungicidal dips (52°C-5min dip)
- Storage (12°C; 80-85%RH) for 21 days
- Ripening (30°C, 50-60%RH)
Effect of pre (a) and postharvest (b) fungicidal applications on postharvest disease development (severity)
Postharvest Application of TBZ (900mg/L) + Sportak (0.5ml/L) gave maximum Disease Control
3. Management Strategies

d) Impact of pre and postharvest fungicidal applications (cv. Sufaid Chaunsa) (2011)

Tested Chemicals

1. Nativo (0.3g/L)
2. Cabriotop (3g/L)
3. Scholar (0.6ml/L)
4. Amistar (0.8ml/L)
5. Sportak (0.5ml/L)

Findings:

• Preharvest application of Scholar better disease control at retail
• Postharvest application of Sportak (A.I. Prochloraz) affective against Anthracnose
3. Management Strategies

e) Impact of postharvest fungicidal applications (cv. SB Chaunsa)

At ripening after 4 weeks storage (11±1°C; 80-85%RH)
ASLP Mango Supply Chain Management Project

After 4 week storage

Control   HW   Nativo-HW   Scholar-HW   Sportak-HW   Amistar-HW

At ripening

Control   HW   Nativo-HW   Scholar-HW   Sportak-HW   Amistar-HW
4. Management Strategies

f) In Vitro Studies

**Studies Chemicals**

- Cabriotop
- Nativo
- Scholar
- Tecto
- Amistar
- Prochloraz

**Concentrations (ppm)**

- 50, 100, 150, 200, 250
Mycelial appearance of *Phomopsis mangiferae*

250 ppm Nativo was most affective against *P. mangiferae*
Mycelial Appearance of *Colletotrichum gloeosporioides*

200ppm Procholraz was most effective against *C. gloeosporioides*
Mycelial Appearance of *Botryodiplodia theobromae*

200 and 250 ppm Prochloraz, Nativo and Tecto were equally affective against *B. theobromae*
Mycelial appearance of *Alternaria alternata*

Nativo (200 & 250 ppm) was most affective followed by Tecto and Prochloraz against *A. alternata*
Mycelial Appearance of *Aspergillus niger*

Prochloraz (200 & 250 ppm) was most affective followed by Scholar
Mango Quality Improvement Workshops

Ms Jodie Campbell Training Workshop Participants at Ali Tareen Farm, Lodhran

Mango Quality Improvement Workshop Participants at Khakwani Fruit Farm, Shujaabad
Conclusions

• Post-harvest diseases (Anthracnose and Stem End Rot) are the major causes of postharvest losses at wholesale and retail.

• Side rot is the major disease followed by SER and Anthracnose.

• Phomopsis mangiferae, Alternaria alternata and Botryodipodia Spp. were isolated from rotten tissues.

• Scholar, a potential new chemistry fungicide, gave better results at preharvest level.

• Prochloraz was affective against anthracnose.

• Nativo gave comparatively better management of SER in SB Chaunsa mangoes.

• Precooling coupled with HW fungicidal dips can give better disease management at postharvest level.

• Diseases management at farm/pre-harvest stage is critical for disease control at postharvest/storage/shipping stage.
Ongoing Studies

- Orchard ratings
- Irradiation
- Temperature management
- Exploring new chemistry fungicides
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