Developing and adopting appropriate technology in ‘superfruits’ production

Bob Williams
Assumptions

1. A Superfruit is:-
   - a fruit from a tree
   - is grown by a farmer to make money
   - are currently being produced and marketed but have some constraints to the production and consumer update.

2. Present here today are:-
   - predominately researchers, research administrators, possible some R&D funding agencies
   - but very few growers, supply chain logistics people or marketers.
Presentation Context

- Focused at the researcher and research administrator
- Determining the priority research issues for this new product – a superfruit
- Develop RD&E team to address these priority issues
- Transfer these technologies through to people in the production (grower – small and or large corporate) and supply chain.
- Emerging concerns about loss of scientific rigor
- An example based on the mango project that we are commencing in Cambodia.
- So in this case mango is my superfruit.
A Possible Superfruit

DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES
The Task

1. To provide a Situation Analysis of production practices, transport infrastructure, market supply chains and support services across the demographic and geographic range of the mango industry in Cambodia.

2. To provide recommendations on key research priorities and investment strategies required to address the productivity and supply chain constraints to achieve increased and sustainable mango production in Cambodian mango industry.

3. To design a preliminary pathway to adoption for the mango industry from the research outcomes and insuring linkages to the supply chain and a program to build the scientific fruit research capacity of Cambodian research scientists and extension workers as well as other service providers.
The Problem

Did not really know the characteristics of the Cambodian Mango industry:

- The size
- The major varieties
- How it was grown
- Where the major production areas were
- What were their markets
- Cost of production
- What were the constraints to development
- Who was providing the expertise/knowledge
- etc
The Methodology

1. Preliminary look see.

<table>
<thead>
<tr>
<th>Estimated Yield from 10 year old trees</th>
<th>Good Season</th>
<th>Poor Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal flowering</td>
<td>150-200 kg/tree</td>
<td>80-100 kg/tree</td>
</tr>
<tr>
<td>Off-season flowering</td>
<td>200-250 kg/tree</td>
<td>120-150 kg/tree</td>
</tr>
</tbody>
</table>
2. Detailed Survey – 6 months
Project team:
- CARDI
- Department of Agriculture
  - Horticulture
  - Plant Protection
  - Provincial departments
- Royal Agriculture University
- Regional Universities
- 5 production regions
- 20 growers per region
The Methodology
2. Detailed Survey – 6 months

Training the survey team.

- Basic understanding of:
  - Mango Phenology
  - Mango varieties
  - Pests and diseases
  - Cropping practices
  - Supply chains
  - Packaging systems
  - Economic analysis
  - Data analysis
- The survey – 1 to 2 hours per grower. (63 questions)
The Methodology
## The Results

<table>
<thead>
<tr>
<th>Province</th>
<th>On - Good</th>
<th>On - Poor</th>
<th>Off - Good</th>
<th>Off - Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battam Bang</td>
<td>32.4</td>
<td>12.3</td>
<td>6.3</td>
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<tr>
<td>Kampong Cham</td>
<td>17.5</td>
<td>7.7</td>
<td>2.0</td>
<td>1.1</td>
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<tr>
<td>Kampong Speu</td>
<td>14.7</td>
<td>6.8</td>
<td>18.9</td>
<td>10.1</td>
</tr>
<tr>
<td>Kandal</td>
<td>29.7</td>
<td>16.8</td>
<td>31.6</td>
<td>13.6</td>
</tr>
<tr>
<td>Siem Reap</td>
<td>20.8</td>
<td>9.1</td>
<td>3.7</td>
<td>2.9</td>
</tr>
<tr>
<td>Grand Total</td>
<td>22.8</td>
<td>10.5</td>
<td>12.6</td>
<td>6.1</td>
</tr>
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</table>
## Area (ha) of Mangoes by Soil Type in Survey

<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Clay</th>
<th>Clay loam</th>
<th>KanDegr</th>
<th>Loam</th>
<th>missing</th>
<th>Other</th>
<th>Sandy</th>
<th>Sandy loam</th>
<th>Grand Total</th>
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<tr>
<td>Battam Bang</td>
<td>Banon</td>
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<td></td>
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<td>23.58</td>
<td>2.37</td>
<td>0.74</td>
<td></td>
<td>7.39</td>
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<td>54.32</td>
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<td>Cheoung Prey</td>
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<td>0.10</td>
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</tbody>
</table>
The Results

Assessment of Diseases
On-season crop

- scab
- anthracnose
- blossom blight
- powdery mildew
- bacterial black spot
- scale
- mango midge
- Fungal (in book guide)
- fruit boring
- burned skin
- Algal (in book guide)

Number of votes
Assessment of Diseases
Off-season crop

- blossom blight
- anthracnose
- scab
- powdery mildew
- burned skin
- bacterial blackspot

Number of votes
The Results.
The Results.

The specific project objectives for Cambodia are:

• To develop and evaluate integrated crop management strategies for productive and profitable high yielding orchards that produce quality fruit that meet international export standards.

• To identify and prioritise the key supply chain constraints, including postharvest losses, packaging, storage and transport to deliver mangoes into selected markets.

• To design and implement a pathway to adoption of improved management options for the Cambodian mango industry encompassing both on farm production and the supply chain.

• To build the capacity of the Cambodian research, development and extension system to deliver targeted and practical outputs to agribusinesses and farmers.
The Next Steps

Project starts in August 2013
Emerging concerns in horticultural research

a. Ethephon for hardening off vegetative growth.
   - Product name v’s active ingredient
   - Date of application v’s stage of phenology development
   - Date of harvest v’s stage of fruit maturity
   - Water quality – pH

[Images of plant with checkmarks and x]
Emerging concerns in horticultural research

b. Potassium Nitrate for floral induction

- Which formulation of $\text{KNO}_3$
- Date of application vs stage of phenology development
- Uniformity in stage of phenology development
- Date of harvest vs stage of fruit maturity
- Missed opportunity to extract more from data
Mango Phenological cycle

- Flowering and fruit set
- Fruit Development
- Harvest
- Vegetative Flushing
- Flower Bud Development
- Root Flush
- Vegetative Dormancy Period
- MJO FT gene

Months:
- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec
Mango Phenological cycle

Effect of Treatment on mean flowering intensity over time.
Days after first treatment.
The Madden-Julian Oscillation (MJO) is the major fluctuation in tropical weather on weekly to monthly timescales. The MJO can be characterized as an eastward moving "pulse" of cloud and rainfall near the equator that typically recurs every 30 to 60 days.
Emerging concerns in horticultural research

c. Reduction in students attracted to Agricultural Science.
d. Those attracted are not the best students
e. Lack of general agricultural knowledge of those students in Agriculture
f. Majority of new graduates only want to work in laboratories
g. Publish or perish – tree fruit research is long term
   ▪ Nutrition research v’s a diagnostic test for mango malformation.

h. nn
Thanks to the research teams in
• Pakistan, Sri Lanka, Philippines, Indonesia and Australia.
• Australian Centre for International Agricultural Research (ACIAR).