UNIT 1
STATUS OF HORTICULTURAL CROP INDUSTRY

Introduction

The word horticulture comes from the Latin hortus "garden" and cultūra "cultivation". The three main branches in horticulture include: pomology (fruit), olericulture (vegetable) and floriculture or ornamental landscape. The different microclimate and topography of Malaysia enable the country produces tropical and temperate fruits, vegetables and flowers all year round. The horticultural crop industry plays an important role in Malaysia economy.

Objective

1. To know the major horticultural crop production area in Malaysia
2. To discuss the yield and production value of horticultural crop
3. To know the quantity and value of import and export of horticultural crop in Malaysia
Topic 1: Status of fruit industry in Malaysia

Important Content

<table>
<thead>
<tr>
<th>Type of Fruit</th>
<th>Luas Bertanam (ha)</th>
<th>Luas Berhasil (ha)</th>
<th>Pengeluaran (mt)</th>
<th>Nilai Pengeluaran (RM'000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buah Bermusim</td>
<td>135,643</td>
<td>88,740</td>
<td>570,533</td>
<td>2,067,997</td>
</tr>
<tr>
<td>Buah Tidak Bermusim</td>
<td>84,227</td>
<td>66,258</td>
<td>1,002,866</td>
<td>1,908,020</td>
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<tr>
<td>Malaysia</td>
<td>219,870</td>
<td>152,998</td>
<td>1,573,393</td>
<td>4,876,017</td>
</tr>
</tbody>
</table>

State with major production of selected fruit crops in Malaysia, 2011

<table>
<thead>
<tr>
<th>Fruits</th>
<th>State</th>
<th>Hectare (Ha)</th>
<th>Production (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starfruit</td>
<td>Selangor</td>
<td>258.6</td>
<td>3,810.6</td>
</tr>
<tr>
<td>Papaya</td>
<td>Johor</td>
<td>559.9</td>
<td>16,026.7</td>
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<tr>
<td></td>
<td>Pahang</td>
<td>489.0</td>
<td>5,385.8</td>
</tr>
<tr>
<td>Durian</td>
<td>Johor</td>
<td>24,736.1</td>
<td>92,030.7</td>
</tr>
<tr>
<td></td>
<td>Pahang</td>
<td>9,820.1</td>
<td>74,645.4</td>
</tr>
<tr>
<td>Guava</td>
<td>Johor</td>
<td>713.8</td>
<td>10,868.7</td>
</tr>
<tr>
<td></td>
<td>Perak</td>
<td>1,474.8</td>
<td>6,357.9</td>
</tr>
<tr>
<td>Banana</td>
<td>Johor</td>
<td>7,325.8</td>
<td>106,709.5</td>
</tr>
<tr>
<td>Pineapple</td>
<td>Johor</td>
<td>8,691.8</td>
<td>187,025.5</td>
</tr>
<tr>
<td>Jackfruit</td>
<td>Pahang</td>
<td>1,745.9</td>
<td>13,924,410</td>
</tr>
<tr>
<td>Mango</td>
<td>Perak</td>
<td>1,341.0</td>
<td>4,270.1</td>
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<tr>
<td></td>
<td>Melaka</td>
<td>922.0</td>
<td>3,862.0</td>
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<td></td>
<td>Pahang</td>
<td>386.9</td>
<td>3,273.8</td>
</tr>
<tr>
<td></td>
<td>Sarawak</td>
<td>1,319.2</td>
<td>2,449.8</td>
</tr>
<tr>
<td></td>
<td>Sabah</td>
<td>1,146.6</td>
<td>2,374.9</td>
</tr>
<tr>
<td></td>
<td>Perlis</td>
<td>317.8</td>
<td>1,030.9</td>
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<td>Watermelon</td>
<td>Kedah</td>
<td>4,153.6</td>
<td>51,673.8</td>
</tr>
<tr>
<td></td>
<td>Johor</td>
<td>3,062.3</td>
<td>65,711.6</td>
</tr>
<tr>
<td></td>
<td>Kelantan</td>
<td>1,423.2</td>
<td>26,535.5</td>
</tr>
<tr>
<td>Pomelo</td>
<td>Johor</td>
<td>428.2</td>
<td>2,928.0</td>
</tr>
<tr>
<td></td>
<td>Perak</td>
<td>135.4</td>
<td>1,168.3</td>
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**JADUAL 1 - 7: KELUASAN, PENGELUARAN DAN NILAI PENGELUARAN TANAMAN BUAH-BUAHAN UTAMA, MALAYSIA, 2011**

**Table 1 - 7: Hectarage, Production and Value Production of Major Fruit Crops, Malaysia 2011**

<table>
<thead>
<tr>
<th>Jenis Buan / Type of Fruits</th>
<th>Luas Berlanjut Planted Area (ha)</th>
<th>Luas Berhasil Harvested Area (ha)</th>
<th>Peratusan Luas Berhasil Percentage of Harvested Area (%)</th>
<th>Pengeluaran Production (mt)</th>
<th>Nilai Pengeluaran Value of Production (RM '000)</th>
<th>Purata Hasil Average Yield (mt/ha)</th>
<th>Hasil Potensi Potential Production (mt/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belimbing / Starfruit</td>
<td>1,050.6</td>
<td>613.6</td>
<td>77.5</td>
<td>10,485.2</td>
<td>43,617,316</td>
<td>12.9</td>
<td>35</td>
</tr>
<tr>
<td>Biji Buah / Pulao</td>
<td>2,462.4</td>
<td>2,102.5</td>
<td>85.4</td>
<td>43,364.3</td>
<td>68,948,276</td>
<td>20.6</td>
<td>60</td>
</tr>
<tr>
<td>Cempedak (Cempedak)</td>
<td>7,393.5</td>
<td>5,212.3</td>
<td>66.0</td>
<td>32,749.3</td>
<td>70,625,558</td>
<td>8.3</td>
<td>15</td>
</tr>
<tr>
<td>Ciku / Sapoja</td>
<td>711.1</td>
<td>490.0</td>
<td>68.7</td>
<td>4,570.3</td>
<td>15,475,916</td>
<td>9.2</td>
<td>29</td>
</tr>
<tr>
<td>Dokong (Dokong)</td>
<td>10,394.5</td>
<td>6,005.4</td>
<td>55.7</td>
<td>23,854.6</td>
<td>107,334,330</td>
<td>3.9</td>
<td>12</td>
</tr>
<tr>
<td>Duku / Duku</td>
<td>9,320.6</td>
<td>5,727.5</td>
<td>57.7</td>
<td>35,113.2</td>
<td>147,262,821</td>
<td>6.1</td>
<td>10</td>
</tr>
<tr>
<td>Durian / Durian</td>
<td>76,399.0</td>
<td>49,540.0</td>
<td>64.8</td>
<td>363,420.5</td>
<td>2,152,671,645</td>
<td>7.3</td>
<td>13</td>
</tr>
<tr>
<td>Jambu / Jambu / Guava</td>
<td>3,011.0</td>
<td>2,151.4</td>
<td>71.4</td>
<td>25,106.2</td>
<td>60,478,722</td>
<td>11.7</td>
<td>40</td>
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<tr>
<td>Langsat / Langsat</td>
<td>5,647.1</td>
<td>3,579.7</td>
<td>59.6</td>
<td>24,926.4</td>
<td>71,624,446</td>
<td>7.4</td>
<td>5</td>
</tr>
<tr>
<td>Limau Besar / Pomelo</td>
<td>1,393.6</td>
<td>1,117.5</td>
<td>80.2</td>
<td>7,867.2</td>
<td>25,238,364</td>
<td>7.0</td>
<td>11</td>
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<tr>
<td>Limau Manis / Sweet Orange</td>
<td>5,046.5</td>
<td>3,138.8</td>
<td>62.2</td>
<td>22,560.1</td>
<td>74,187,107</td>
<td>7.2</td>
<td>24</td>
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<tr>
<td>Mangga / Mango</td>
<td>7,175.6</td>
<td>4,773.1</td>
<td>66.8</td>
<td>21,021.5</td>
<td>111,090,525</td>
<td>4.4</td>
<td>7</td>
</tr>
<tr>
<td>Manggis / Manggis selatan</td>
<td>4,267.9</td>
<td>2,650.3</td>
<td>66.9</td>
<td>21,554.5</td>
<td>63,078,703</td>
<td>7.6</td>
<td>22</td>
</tr>
<tr>
<td>Malai Naga / Dragon Fruit</td>
<td>1,244.4</td>
<td>962.8</td>
<td>77.4</td>
<td>7,942.9</td>
<td>42,624,751</td>
<td>8.2</td>
<td>10</td>
</tr>
<tr>
<td>Nenas / Pineapple</td>
<td>14,922.0</td>
<td>10,462.3</td>
<td>70.1</td>
<td>309,330.6</td>
<td>512,566,116</td>
<td>29.6</td>
<td>62</td>
</tr>
<tr>
<td>Naranja / Jeruk</td>
<td>4,260.8</td>
<td>2,695.4</td>
<td>66.0</td>
<td>23,734.9</td>
<td>55,344,266</td>
<td>8.2</td>
<td>19</td>
</tr>
<tr>
<td>Pisang / Banane</td>
<td>29,131.5</td>
<td>24,060.3</td>
<td>82.6</td>
<td>306,262.8</td>
<td>531,623,083</td>
<td>12.7</td>
<td>24</td>
</tr>
<tr>
<td>Pulasan / Pulasan</td>
<td>671.0</td>
<td>503.4</td>
<td>76.5</td>
<td>1,978.2</td>
<td>7,578,931</td>
<td>3.9</td>
<td>8</td>
</tr>
<tr>
<td>Rainbouin / Rainbouin</td>
<td>18,549.6</td>
<td>12,633.6</td>
<td>67.7</td>
<td>63,344.9</td>
<td>323,065,237</td>
<td>5.0</td>
<td>8</td>
</tr>
<tr>
<td>Salak / Salak</td>
<td>1,259.6</td>
<td>803.8</td>
<td>63.8</td>
<td>3,569.5</td>
<td>15,969,093</td>
<td>4.5</td>
<td>9</td>
</tr>
<tr>
<td>Tembikai / Water-tembikan</td>
<td>13,814.3</td>
<td>13,279.4</td>
<td>96.1</td>
<td>220,559.6</td>
<td>327,427,681</td>
<td>16.6</td>
<td>30</td>
</tr>
<tr>
<td><strong>Malaysia</strong></td>
<td><strong>218,865.8</strong></td>
<td><strong>152,588.3</strong></td>
<td><strong>69.6</strong></td>
<td><strong>1,573,383.1</strong></td>
<td><strong>4,876,017,083</strong></td>
<td><strong>10.3</strong></td>
<td><strong>---</strong></td>
</tr>
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</table>

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**JADUAL 3 - 8: DATA PERDAGANGAN BUAH-BUAHAN (TROPIKAL DAN BUKAN TROPIKAL), MALAYSIA, 2007 - 2011**

**Table 3 - 6: Trade Data - Fruits (Tropical and Non-Tropical), Malaysia, 2007 - 2011**

<table>
<thead>
<tr>
<th>Keterangan Description</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eksport</strong> / <strong>Export</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Kuantiti Quantity (mt)</td>
<td>367,062</td>
<td>287,852</td>
<td>248,769</td>
<td>290,660</td>
<td>314,610</td>
</tr>
<tr>
<td>Nilai Value (RM ’000)</td>
<td>459,609</td>
<td>487,194</td>
<td>492,292</td>
<td>589,665</td>
<td>625,916</td>
</tr>
<tr>
<td><strong>Import</strong> / <strong>Import</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuantiti Quantity (mt)</td>
<td>6,870,457</td>
<td>2,063,491</td>
<td>503,026</td>
<td>649,780</td>
<td>690,027</td>
</tr>
<tr>
<td>Nilai Value (RM ’000)</td>
<td>883,318</td>
<td>1,104,348</td>
<td>1,240,006</td>
<td>1,389,170</td>
<td>1,591,672</td>
</tr>
<tr>
<td><strong>Imbangan</strong> / <strong>Balance of Trade</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuantiti Quantity (mt)</td>
<td>-6,503,355</td>
<td>-1,775,630</td>
<td>-344,257</td>
<td>-365,124</td>
<td>-375,417</td>
</tr>
<tr>
<td>Nilai Value (RM ’000)</td>
<td>-423,709</td>
<td>-617,154</td>
<td>-747,714</td>
<td>-789,605</td>
<td>-965,756</td>
</tr>
</tbody>
</table>

Imbangan Perdagangan = Eksport - Import
Balance of Trade = Export - Import
Topic 2: Status of vegetable industry in Malaysia

Important Content

**Table 1.2: Trade Data - Export, Import and Balance of Trade for Vegetables, Malaysia, 2011**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Exports (Ton)</th>
<th>Imports (Tan)</th>
<th>Balance of Trade</th>
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</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>281.391</td>
<td>1,357.962</td>
<td>-1,076,571</td>
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<tr>
<td>Value (RM'000)</td>
<td>750,786</td>
<td>2,734,400</td>
<td>-1,983,612</td>
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</tbody>
</table>

*Source: Ministry of Agriculture and Agro-based Industry Malaysia*

**Table 1.3 (A): Hectareage and Production Of Major Vegetables, Malaysia by Types, 2011**

<table>
<thead>
<tr>
<th>Jenis Sayur</th>
<th>Luas Bertanam Planted area (Ha)</th>
<th>Luas Berhasil Harvested area (Ha)</th>
<th>Pengeluaran Production (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayam</td>
<td>2,586.77</td>
<td>2,526.67</td>
<td>28,676.01</td>
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<tr>
<td>Bendi</td>
<td>2,350.29</td>
<td>2,159.14</td>
<td>28,470.99</td>
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<tr>
<td>Cili</td>
<td>243.52</td>
<td>212.98</td>
<td>879.83</td>
</tr>
<tr>
<td>Cekur Manis</td>
<td>365.63</td>
<td>294.03</td>
<td>4,810.34</td>
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<td>Daun Bawang</td>
<td>400.68</td>
<td>396.82</td>
<td>5,951.49</td>
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<td>Daun Senor</td>
<td>247.58</td>
<td>247.58</td>
<td>6,925.20</td>
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<td>Kacang Buncis</td>
<td>551.45</td>
<td>621.46</td>
<td>6,704.33</td>
</tr>
<tr>
<td>Kacang Panjang</td>
<td>3,083.18</td>
<td>3,059.92</td>
<td>42,922.68</td>
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<td>Kailan</td>
<td>1,184.98</td>
<td>1,149.23</td>
<td>14,327.17</td>
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<td>Kangkung</td>
<td>5,014.92</td>
<td>5,767.65</td>
<td>74,092.50</td>
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<td>Korbis Bulat</td>
<td>5,684.95</td>
<td>5,110.72</td>
<td>179,322.92</td>
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<tr>
<td>Kacang Botol</td>
<td>89.79</td>
<td>83.38</td>
<td>548.81</td>
</tr>
<tr>
<td>Kordur</td>
<td>156.30</td>
<td>137.45</td>
<td>2,061.48</td>
</tr>
<tr>
<td>Kukul</td>
<td>101.81</td>
<td>95.48</td>
<td>879.11</td>
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<td>Korbis Cina</td>
<td>613.09</td>
<td>611.69</td>
<td>18,692.74</td>
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<td>Labu Air</td>
<td>408.07</td>
<td>368.85</td>
<td>5,552.72</td>
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<tr>
<td>Labu Manis</td>
<td>1,603.22</td>
<td>1,589.29</td>
<td>21,594.40</td>
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<tr>
<td>Lobak Merah</td>
<td>28.90</td>
<td>28.90</td>
<td>338.74</td>
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<tr>
<td>Lobak Putih</td>
<td>99.20</td>
<td>99.00</td>
<td>2,420.85</td>
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<tr>
<td>Peria</td>
<td>1,133.03</td>
<td>979.65</td>
<td>14,447.45</td>
</tr>
<tr>
<td>Petola</td>
<td>1,337.76</td>
<td>1,231.72</td>
<td>18,946.06</td>
</tr>
<tr>
<td>Salad</td>
<td>2,459.63</td>
<td>2,490.41</td>
<td>36,202.88</td>
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<td>Sawi</td>
<td>6,171.68</td>
<td>8,072.42</td>
<td>128,547.14</td>
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<td>Terung</td>
<td>1,782.67</td>
<td>1,847.44</td>
<td>36,653.27</td>
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<td>Timun</td>
<td>3,968.53</td>
<td>3,558.92</td>
<td>67,250.65</td>
</tr>
<tr>
<td>Tomato</td>
<td>1,451.35</td>
<td>1,394.92</td>
<td>137,128.40</td>
</tr>
<tr>
<td>Jumlah</td>
<td>51,777.12</td>
<td>47,967.32</td>
<td>928,182.84</td>
</tr>
</tbody>
</table>
### Table 1-4 (A): Hectareage and Production Of Major Vegetables, Malaysia by State, 2011

<table>
<thead>
<tr>
<th>NEGERI</th>
<th>Luas Bertanam</th>
<th>Luas Berhasil</th>
<th>Pengeluaran</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Planted area</td>
<td>Harvested area</td>
<td>Production</td>
</tr>
<tr>
<td>State</td>
<td>(Ha)</td>
<td>(Ha)</td>
<td>(Mt)</td>
</tr>
<tr>
<td>Johor</td>
<td>43,654.1</td>
<td>40,434.9</td>
<td>833,431.7</td>
</tr>
<tr>
<td>Kedah</td>
<td>3,599.8</td>
<td>3,592.4</td>
<td>47,770.7</td>
</tr>
<tr>
<td>Kelantan</td>
<td>4,904.6</td>
<td>4,901.7</td>
<td>55,581.7</td>
</tr>
<tr>
<td>Melaka</td>
<td>999.2</td>
<td>901.5</td>
<td>9,707.7</td>
</tr>
<tr>
<td>Negeri Sembilan</td>
<td>51,777.1</td>
<td>47,987.3</td>
<td>928,162.9</td>
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<tr>
<td>Sarawak</td>
<td>33.7</td>
<td>27.1</td>
<td>267.8</td>
</tr>
<tr>
<td>Selangor</td>
<td>3.3</td>
<td>3.1</td>
<td>11.5</td>
</tr>
<tr>
<td>Terengganu</td>
<td>65.8</td>
<td>50.2</td>
<td>115.2</td>
</tr>
<tr>
<td>Perlis</td>
<td>53.0</td>
<td>3.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Pahang</td>
<td>4.0</td>
<td>4.0</td>
<td>137.3</td>
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<tr>
<td>Perak</td>
<td>317.6</td>
<td>317.6</td>
<td>6,758.9</td>
</tr>
<tr>
<td>Pulau Pinang</td>
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<td>1.5</td>
<td>9.7</td>
</tr>
<tr>
<td>Sem. Malaysia</td>
<td>487.9</td>
<td>469.4</td>
<td>7,907.0</td>
</tr>
<tr>
<td>Sabah</td>
<td>619.4</td>
<td>619.4</td>
<td>2,515.1</td>
</tr>
<tr>
<td>W.P. Labuan</td>
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<td>1.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1,108.3</td>
<td>1,089.8</td>
<td>10,427.1</td>
</tr>
</tbody>
</table>
Topic 3: Status of floriculture/ornamental crop industry in Malaysia

![Image of table]

**Table 11.1: Planted Area and Production of Flowers by State**

<table>
<thead>
<tr>
<th>NEGERI</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Jodoh</td>
<td>1,063</td>
<td>1,021</td>
<td>1,033</td>
<td>1,043</td>
<td>1,066</td>
</tr>
<tr>
<td>Pahang</td>
<td>27</td>
<td>140</td>
<td>217</td>
<td>278</td>
<td>30</td>
</tr>
<tr>
<td>Kapar</td>
<td>13</td>
<td>851</td>
<td>1,079</td>
<td>1,016</td>
<td>29</td>
</tr>
<tr>
<td>Selangor</td>
<td>22</td>
<td>137</td>
<td>132</td>
<td>146</td>
<td>166</td>
</tr>
<tr>
<td>Kedah</td>
<td>7</td>
<td>502</td>
<td>510</td>
<td>660</td>
<td>763</td>
</tr>
<tr>
<td>Perak</td>
<td>128</td>
<td>1,480</td>
<td>1,532</td>
<td>1,643</td>
<td>1,801</td>
</tr>
<tr>
<td>Melaka</td>
<td>1</td>
<td>58</td>
<td>74</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Pahang</td>
<td>229</td>
<td>99,589</td>
<td>74,020</td>
<td>91,349</td>
<td>102,635</td>
</tr>
<tr>
<td>Selangor</td>
<td>262</td>
<td>2,441</td>
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</tr>
<tr>
<td>Negeri Sembilan</td>
<td>7</td>
<td>76</td>
<td>70</td>
<td>61</td>
<td>80</td>
</tr>
<tr>
<td>WP. Kuala Lumpur</td>
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</table>

**Table 11.4: Number of Plants Planted and Productions According to Type of Flower Plants**

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<tbody>
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<td>144,728,478</td>
<td>78,175,817</td>
<td>75,668,430</td>
<td>78,845,210</td>
<td>80,045,210</td>
</tr>
<tr>
<td>Total Plants</td>
<td>9,793,597</td>
<td>13,779,833</td>
<td>12,143,907</td>
<td>12,800,670</td>
<td>13,492,960</td>
<td>13,792,960</td>
</tr>
<tr>
<td>Pekok Bunga</td>
<td>11,954,880</td>
<td>119,716,301</td>
<td>42,822,998</td>
<td>40,880,570</td>
<td>40,962,330</td>
<td>41,262,330</td>
</tr>
<tr>
<td>Non-Orchid Plants</td>
<td>2,436,102</td>
<td>1,187,537</td>
<td>17,980,385</td>
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<td>12,417,700</td>
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<tr>
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</tr>
</tbody>
</table>
### Jadual 11.4 (samb.) : Bilangan Pokok Ditanam dan Pengeluaran Mengikut Jenis Pokok Bunga

**Table 11.4 (cont’d.) : Number of Plants Planted and Productions According to Type of Flower Plants**

<table>
<thead>
<tr>
<th>PERKARA Item</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jumlah Pengeluaran (keratan atau pasu)</td>
<td>146,893,699</td>
<td>178,116,314</td>
<td>135,145,712</td>
<td>146,099,730</td>
<td>149,907,850</td>
<td>160,133,980</td>
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<tr>
<td>Total Production (cuttings or pet)</td>
<td>110,999,878</td>
<td>127,050,777</td>
<td>96,384,905</td>
<td>126,781,520</td>
<td>133,712,330</td>
<td>144,654,500</td>
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<tr>
<td>Nilai Pengeluaran (RM)</td>
<td>41,489,928</td>
<td>22,482,170</td>
<td>17,057,986</td>
<td>17,057,700</td>
<td>17,350,500</td>
<td>18,220,430</td>
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<tr>
<td>Production Value (RM)</td>
<td>26,054,598</td>
<td>13,703,382</td>
<td>10,399,898</td>
<td>10,462,520</td>
<td>11,110,240</td>
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<tr>
<td>Bunga Keratan Orkid</td>
<td>83,440,930</td>
<td>104,450,821</td>
<td>79,247,873</td>
<td>78,197,120</td>
<td>78,935,980</td>
<td>87,529,660</td>
</tr>
<tr>
<td>Pengeluaran (keratan atau pasu)</td>
<td>83,440,930</td>
<td>104,450,821</td>
<td>79,247,873</td>
<td>78,197,120</td>
<td>78,935,980</td>
<td>87,529,660</td>
</tr>
<tr>
<td>Production (cutting or pet)</td>
<td>37,428,285</td>
<td>72,925,614</td>
<td>55,323,773</td>
<td>75,682,920</td>
<td>84,770,650</td>
<td>84,764,870</td>
</tr>
<tr>
<td>Nilai Pengeluaran (RM)</td>
<td>37,428,285</td>
<td>72,925,614</td>
<td>55,323,773</td>
<td>75,682,920</td>
<td>84,770,650</td>
<td>84,764,870</td>
</tr>
<tr>
<td>Production Value (RM)</td>
<td>1,289,984</td>
<td>6,402,326</td>
<td>4,856,977</td>
<td>7,085,460</td>
<td>2,160,460</td>
<td>8,502,550</td>
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<tr>
<td>Daun Keratan</td>
<td>19,644,654</td>
<td>4,834,364</td>
<td>3,671,006</td>
<td>5,134,510</td>
<td>6,831,155</td>
<td>6,361,410</td>
</tr>
<tr>
<td>Foliage</td>
<td>19,644,654</td>
<td>4,834,364</td>
<td>3,671,006</td>
<td>5,134,510</td>
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<td>6,361,410</td>
</tr>
</tbody>
</table>

**Addition reference(s)**

1. www.doa.gov.my
UNIT 2
CLASSIFICATION AND BOTANY OF HORTICULTURAL CROP

Introduction

Horticultural crop can be classified taxonomically, botanically or classified according to the usage of the crop, the growth cycle, light requirement, temperature etc.

Objective

1. To discuss the way of classification of horticultural crop
**Topic 1: Taxonomy**

### Important Content

Plant are classified according to family, genus, species, variety, cultivar.

<table>
<thead>
<tr>
<th>Family</th>
<th>Rosaceae</th>
<th>Rosaceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genus</td>
<td>Rosa</td>
<td>Fragaria</td>
</tr>
<tr>
<td>Species</td>
<td><em>Rosa indica</em></td>
<td><em>Fragaria × ananassa</em></td>
</tr>
</tbody>
</table>

![Image 1](image1.png) ![Image 2](image2.png)

*Image 1: Rose flower*  
*Image 2: Strawberry plant*
**Topic 2: Botany**

**Important Content**

Plants are classified botanically.

- **Leaves**
  - Broad leaves
    - Most leafy vegetable: lettuce, spinach
  - Bulb
    - Modified leaf, enlarge fleshy leaves surrounding a very short stem
    - Onion, tulip, rain-lily

- **Stem**
  - Above ground
    - Asparagus, bamboo shoot
  - Under ground
    - Tuber: modified stem bearing buds or eyes
      - Potato, dahlia
    - Rhizome: elongated horizontal stem with buds and dried leaf sheets
      - Ginger, curcuma, lotus
    - Corm: short thicken under ground stem, upright in position
      - Yam, water chestnut, banana

- **Roots**
  - Tap root
    - Carrot, sengkuang
  - Adventitious root
    - Sweet potato

- **Fruits**
  - **Simple fruit**
    - Dry fruit
      - Harvest young/immature
        - Long bean, okra, sweet pea
      - Harvest when matured
        - Groundnut, trapa
- Succulent fruit
  - Drupe
    - Fleshy
    - One or more seeds
    - Pericarp differentiated into:
      - Epicarp: outer skin
      - Mesocarp: often fleshy or sometime fibrous
      - Endocarp: hard and stony
    - Mango, coconut, plum
  - Berry
    - Fleshy
    - Ovary superior or inferior
    - Usually many seeds
    - Developed from a syncarpous pistil with axile or pariental placentation
    - Papaya, banana, guava, starfruit, grape, mangoesteen
  - Pepo
    - Fleshy
    - Many seeded fruit like berry
    - Developed from an inferior, one celled or three celled syncarpous pistil with parietal placentation
    - Watermelon, muskmelon, cucumber, pumpkin
  - Pome
    - Fleshy
    - Ovary inferior, two or more celled
    - Syncarpous fruit surrounded by the thalamus
    - The fleshy edible part is composed of the thalamus while the actual fruit lies within.
    - Apple, pear
  - Hesperidium
    - Fleshy, ovary superior, many celled with axile placentation
    - Endocarp projects inwards forming distinct chambers.
• Epicarp and mesocarp fused together to form the separable skin or rind of the fruit.
  - Orange, lemon, pomelo

• Aggregate fruit
  • Group of simple fruit form from an apocarpous pistil (free carpel) of a flower.
  • Each free carpel will form fruit, thus many fruits form from one flower.
  - Strawberry, anona, soursop

• Composite fruit
  • Fruit developed from a bunch of flowers.
  • The flowers grow near to each other or fused together.
  • Also known as multiple fruits.
  - Pineapple, jackfruit, cempedak

• Flowers
  • Young flower
  - Cauliflower, broccoli
**Topic 3: Life cycle**

**Important Content**

Plants are classified according to life cycle.

- **Annual**
  - Plants that perform their entire life cycle from seed to flower and produce seeds within a single growing season.
  - All roots, stems and leaves of the plant die annually.
  - Marigold, celosia, watermelon

- **Biennial**
  - Plants which require two years to complete their life cycle.
  - First season growth results in a small rosette of leaves near the soil surface (vegetative growth).
  - During the second season's growth stem elongation, flowering and seed formation occur (reproductive) followed by the entire plant's death.
  - Many biennials require a cold treatment, or vernalization, before they will flower.
  - Tulips

- **Perennial**
  - Plants that persist for many growing seasons.
  - Mango, durian, chrysanthemum
**Topic 4: Usage**

**Important Content**

Plants are classified according to horticultural usage or function.

- **Trees**  
  - Plants with single straight main trunk

- **Shrubs**  
  - Plants with multiple branches from the base /no main trunk

- **Groundcovers**  
  - Low growing herbaceous or woody plants/upright or creeping which covers the ground

- **Vines and climbers**  
  - Plants with special parts – thorns, hooks and tendrils for climbing/support  
  - Requires support/climbing structures – poles, fences and pergola

- **Potted plants**  
  - Potted ornamental plants  
  - Flowering or foliage

- **Indoor plants**  
  - Indoor potted plants  
  - Plants growing under different light, temperature and humidity compared to outdoor plants

- **Bedding plants**  
  - Planted on beds

- **Cut flowers**  
  - Produced specially for cut flowers  
  - Examples: orchids, chrysanthemum (kekwa), rose, carnation (teluki)

- **Edibles**  
  - Produced for consuming
**Topic 5: Light intensity**

**Important Content**

Plants are classified according to amount of light needed to grow. Light intensity is the total light received by plants and it influences the rate of photosynthesis. Photosynthesis rate increases with light intensity until a light saturation point.

Two groups of plant:
- Sun loving plant
- Shade loving plant

**Topic 6: Light duration**

**Important Content**

Photoperiod
- The effects of day and night duration on plant growth
  - Long day plant
    - needs long day (short night duration) for flowering (dahlia, carnation)
  - Short day plant
    - needs short day (long night duration) for flowering (chrysanthemum, poinsettia).
  - Day neutral plant
    - not influence by day/night duration (rose, marigold etc)
Topic 7: Temperature

**Important Content**

The optimum temperature for growth of plants is type/species dependant

- Tropical plants:
  - optimum temperature 30-35°C

- Sub-tropical plants:
  - optimum temperature 25-35°C

- Temperate plants:
  - optimum temperature 20-30°C

- Most plants:
  - 20-30°C

The effects of temperature is more critical for temperate plants compared to tropical plants

Topic 8: Season

**Important Content**

Some plants only grow in certain time in a year due to specific condition and microclimate needed.

- Seasonal fruits
  - Durian, rambutan, mangoesteen, duku, langsat

- Non-seasonal fruits
  - Starfruit, jackfruit, papaya, banana, guava
Topic 9: Plant physiology

**Important Content**

Important in post-harvest handling and storage.

- **Climacteric fruit**
  - ripening-associated increase in respiration and in ethylene production
  - ethylene being the major trigger and coordinator of the ripening process.
  - ripen after harvest, and need not remain on the tree or vine.
  - tomato, apple, pear, banana, mango, papaya, melon

- **Non-climacteric fruits**
  - Respiration rate either remains unchanged or shows a steady decline until senescence intervenes, with no increase in ethylene production
  - lack of ethylene-associated respiratory peak and the signaling pathways that drive the ripening process remain elusive.
  - Brinjal, grape, citrus, rambutan, pineapple

Topic 10: Planted area

**Important Content**

- **Common**
  - Widely planted, large scale production, abundant in the market, easily obtains.
  - Common fruits: Papaya, banana, durian, star fruit, guava, mangoesteen, mango

- **Rare**
  - Seldom planted, planted in small scale for niche market.
  - Rare fruits: Cermai, belimbing buluh, sentul, tampoi
UNIT 3
FLOWERING AND FRUIT SET

Introduction

Flowering is an indication of a matured plant. It is a complicated process which involves biological, chemical and environmental factors. Flowering is very important for horticultural industry (especially for floriculture and fruit crops) as it directly influence the yield. Through knowing the factors that influence flowering, growers are able to manage the crop for maximizing the yield.

Objective

1. To know the process of flower development and fruit set
2. To discuss the factors controlling flowering, fruit set and fruit development
**Topic 1: From vegetative stage to reproductive stage**

**Important Content**

Development phases for plant grown from seed:
- Seed germination and growing → Juvenile/vegetative phase → Transition phase → Maturity/reproductive phase → Senescence

Vegetative propagated plants from cuttings, marcotting and grafting:
- Have shorter juvenile phase
- Able to flower earlier than seed grown plants
- Durian
  - Grafted plant will flower after 5-7 years
  - Seed grown plant flower after 7-9 years

Some morphological changes while entering maturity stage:
- Citrus
  - Juvenile stage: a lot of thorns on stem
  - Matured stage: less or no thorn
- Other symptoms on a matured plant:
  - Begin to flower
  - Lost the ability to produce adventitious root from cuttings

Transition phase from vegetative to reproductive stage
- Not genetically controlled
- Epigenetic factor (changing in gene expression towards the changes of biochemical and physiology)

Originated in meristem apex
- Meristemic cells differentiate to form flower primordial
- Triggered by environment or chemical factors
- Plant apex grow and form inflorescent
The process is stable, hard to reverse to vegetative stage.

Ways to rejuvenate a plant:
- Use phyto-hormones/plant growth regulators
- Hard prune
- High N fertilizer input

**Topic 2: Flower development**

**Important Content**

Flower formation begins with formation of sepals, development of petals, stamen and lastly the carpel.

Flowering of most fruit crops are seasonal
- Durian, mangoesteen, rambutan, pulasan, duku, langsat, cempedak, sukon

Some fruit crops flower and fruit all year round; non-seasonal
- Banana, papaya, starfruit, jackfruit, guava, brinjal, okra, tomato
Site of flowering:
- Differ between plants
- At the terminal of each branch – mango, rambutan, hydrangea, rose
- On the old branches – starfruits, durian
- On the stem – jackfruits, soursop, cannonball tree
- At the terminal of the plants – banana, bromeliads (pineapple), heliconia
- At the base of leaf sheath – palms, phalaenopsis, okra

**Topic 3: Types of flower**

**Important Content**

Complete (perfect) flowers (bisexual, hermaphrodite) – containing functional female and male parts (durian, citrus, guava, starfruits, langsat, tomato)
Incomplete flowers (unisex) – banana, jackfruit, sukun, water melon, cucumber (female and male on different flowers, on the same plants), papaya (female, male, hermaphrodite flowers on different plants)

Both (complete and incomplete) – mango (male and hermaphrodite, different flowers, same plants)

Self-incompatibility

- **i. Self-incompatibility among the short style of complete flowers**
  - e.g. Starfruits
  - Clone B10 – short styles (self-incompatible)
  - Clone B2 - long styles (heterostyle)

![Diagram](image)

*Style length in the flower can be easily identified with a 10× hand lens*

- **ii. Unisex flowers**
  - Monoecious – cempedak, banana, jackfruit, melon (both types of flowers are on the same plants)
  - Diecious – papaya, pala (nutmeg), salak (different types of flowers on different plants)
Topic 4: Factors influence flowering

**Important Content**

Factors influence flowering:

- **Plant age**
  - Juvenile:
    - The period of vegetative growth phase after sowing, regardless of the conditions in which they are grown.
    - Each plant species have to reach a certain age to flower.
      - Durian: 7-9 years
      - Banana: 6-9 months
      - Marigold: 2-3 months
      - Tomato: 3 months
  - Vegetative propagated or grafted plant able to flower earlier.

- **Light**
  - Light duration – photoperiodic
    - Short Day Plant (SDP)
      - e.g. Chrysanthemum, Poinsettia
    - Long Day Plant (LDP)
      - e.g. Carnation
    - Day Neutral Plant (DNP)
      - e.g. Rose
  - Light quality
  - Light intensity

- **Nutrient**
  - carbohydrate/nitrogen relationship
  - High C/N ratio: promote flowering
  - High N will promote vegetative growth

- **Water stress**
  - Some plants may induce to flower by a short period of water stress (1-2 month of drought) - Mangoes, durian, rambutan, jacaranda
• Long period of rain → flower fail to induce → vegetative shoots grow → leaves

**Temperature**

• High temperature along with water stress is needed for most tropical plants to initiate flower.
• Low day and night temperature will injured the floral meristem → flower fail to form or abnormal flower formation
• Flower initiated after a period of low temperature exposure or day/night temperature drop.
• Vernalization: low temperature treatment
  • Temperate and subtropical plants: Cabbage, tulips, lychee
  • Some tropical plants: Moth orchid (*Phalaenopsis*)

**Plant growth regulators**

• Auxins
  • More to inhibition of flowering, blocking axillary meristem release or initiation
• Ethylene
  • Recorded to promote flowering in bromeliads and mango
• Gibberellins
  • Involve in floral transition, resulting in stem elongation or bolting
  • Replace the need of low temperature
  • Increase size of flowers
• Cytokinins
  • May promote/ inhibit, depending on the concentration, site and timing of application, and the amount of other growth substances and carbohydrates present.
  • Control the early mitotic stimulation, precocious initiation of axillary meristems.
• Abscisic acid
  • Not the major determinant in the floral transition, however, may participate in the regulation of the fate of a meristem

**Growth regulation by chemicals**

• Usage of chemical material to change growth
• involves:
- Modification of structure /character of plants
- Changes growth process (germination, rooting, flowering)

• Treatment methods:
  • Foliar spray
  • Soil drench
  • Soak/dip - for bulbs, corms, tubers
  • use – follow the instruction on labels (concentration, time/method of treatment) to:
    - obtain the effects desired
    - would not destroy plants
    - consumers safety
    - protect the environment

• Example:
  • Chlormequat (Cycocel)
  • Ancymidol (A-Rest)
  • Daminozide (B-Nine), (Alar)
  • Paclobutrazol (Bonzi), (Cultar)
  • Flurprimidol (Bloom)
  • Uniconazole (Sumagic)

• Pruning
  • Remove non-productive branches and leaves
  • Reduce competition for assimilates
  • Enable more sunlight penetrate the canopy
  • Influence the flow of hormone distribution
  • Induce more flower in the following season:
    • Rambutan, mulberry

• Rootstock effect
  • Using suitable rootstock will increase the flower numbers and induce early flowering of the scion.
Topic 5: Pollination and fertilization

**Important Content**

- Pollination is a process of transferring of pollen from anthers to the stigma
- The stigma must be in the receptive condition – dehiscent anther and viable pollens, and compatible with stigma for fertilization to occur
- Process: Upon reception on the stigma, a pollen tube with two nuclei sperms (1N for each) develops, grow towards ovary and then ovules:
  - One nucleus will fuse with one egg (1N) to form a zygote (2N) then becomes an embryo
  - Another nuclei will fuse with a two polar nuclei (1 N each) forming an endosperm (3N).
- Success in fertilization and formation of seeds causes ovary to grow

**Self pollination/fertilization**
The pollen fertilizes the ovules in the ovaries of the same flower, other flowers on the same plant, and/or flowers on different plants but of the same cultivar.

**Cross pollination/fertilization**
The pollen is incapable of fertilizing ovules on that plant. The pollen must come from another cultivar of the same species or a plant of closely related species.

Reasons:
- Self-incompatible
  - Needs to be pollinated by pollens from different clones
  - e.g. Durian
    - Clone D24 x Clone D10, D99, D98 or D114
  - Advisable to plants different clones within one orchard to get high yield
- Different times of receptivity of stigma and dehiscent of anthers
  - Hermaphrodite (Male & female organs on the same flowers)
  - Carpel is matured earlier than stamen, when anther dehisced, stigma not longer receptive... fertilization would not occur
  - e.g. soursop, anthurium, amorphophallus
• Heterostyly

**Heterostyly** — Two different types of perfect flowers, each type on a different plant

- Normally pollinate by insects
  - Starfruit: honey bees
  - Mango: flies
  - Melati: moths
  - Ixora: butterflies
- Some by mammals
  - Durian: bats
- Some by birds
  - Heliconia and bromeliads: hummingbirds

• Pollination activity are coincide the time of anthesis, dehiscent of anthers and receptivity of stigma
• Fragrant smell or foul odor are emitted at certain time to attract certain pollinators

**Factors affecting pollination/fertilization process**

• Weather – rain water could wash away the pollens from the stigma and anthers. Also reduce pollinator's activity
• Utilization of chemicals/insecticides – killing pollinators
• Distance between source of pollens and receptive flowers – generally the pollinators do not move far from one plant to another.
• Rearing of honey bees – Limited to the plant species that pollinated by bees. Benefit: high yield & honey production

Effects of pollination on fruit quality
• Insufficient pollination
  – Reduces fruit set
  – Production of low quality fruits
• Low quality fruits – mishapen fruits, small size, unattractive to the customers

Assisted pollination
• Scarce or no natural pollinator
• To improve pollination and fruit set
• Mature flowers are harvested and the stalks are soaked in the water to prolong the shelf life of pollens, use as soon as possible
• Pollination can be performed by rubbing the pollens onto the stigma using a soft brush
• If the time of anthesis is the same as the receptive time of the stigma, pollination can be done by brushing from flowers to flowers.
Topic 6: Fruit set

Important Content

- Fruits form from ovaries and only if the fruits are maintained on the fruiting twigs
- While fruit is growing, petals senesced and dropped
- Only a small % of the flowers produced turn into fruits
- The amount of fruit set and its growth dependent on several factors:
  - Internal factors
    - The distance between fruits: competition for resources (food)
    - Leaf:fruit ratio - fruit thinning promote fruit size, less competing sink
    - Food reserves – alternate bearing, bumper year versus off-year
    - Seeds and their distribution in fruits
  - External factors
    - Temperature and rainfall – high temperature affect the viability of pollens and receptivity of stigma, this affect ovule formation. High rainfall causing fruit drop.
    - Nutrient availability – Fertilization before flowering season encourage fruit set.
    - Excessive fertilizers encourage vegetative growth, inhibit flowering, thus fruiting.
    - Pest and diseases infestation induce fruit drop or delay fruit ripening.
    - Water supply – water stress causing fruit drop.
    - Light – Light promote photosynthesis, increase
    - Carbohydrate availability enables fruit to grow to full size.
    - Prunning help to improve light interception.
**Topic 7: Fruit growth**

**Important Content**

- Involves cell division and enlargement
- Two types of growth:
  1. Single sigmoid – Slow early growth (cell division), followed by a fast growth phase, then the growth rate diminishing.
     - e.g. banana, durian, pineapple, oranges, apple, lychee
  2. Double sigmoid – Begin with a fast growth (cell division), then followed by a moderate growth (hardening of endocarp), and the growth continue until harvest (accumulation of water and solutes).
     - e.g. Dates, guava, peach

*Figure 1. The fruit growth curve of walnut. Error bars indicate standard deviation, n=10.*
Changes during fruit maturation period

- Increase in fruit size
- Increase in soluble solid in cell vacuole,
- Starch is being converted/dehydrolysed into sugars (glucose, fructose, sucrose)
- Reduction in the concentration of organic acids (citric acid, tartaric acid, malic acid, oxalic acid)
- Change in texture from hard to soft
- Increase in water content
- Increase in respiration and ethylene production in climacteric fruits
- Reduction in the amount of chlorophyll (other pigments – anthocyanin, carotene, xanthophylls increasing)
- Increase in aroma