Malling™ Centenary and beyond
Progress from the East Malling Strawberry Breeding Programme, UK

Adam Whitehouse

Berry Seminar
Teagasc Ashtown Research Centre, Dublin
25th April 2019
Strawberry Breeding at East Malling

13,000 seedlings per annum

- Pandora (1988)
- Pegasus (1990)
- Calypso (1991)
- Tango (1994)
- Eros (1994)
- Emily (1995)
- Bolero (1996)
- Laura (1996)
- Florence (1997)
- Sophie (1997)
- Perfection (1998)
- Rosie (1999)
- Alice (2000)
- Flamenco (2002)
- Mae (2003)
- Malling™ Pearl (2005)
- Malling™ Opal (2005)
- Judibell (2005)
- Delia (2005)
- Amelia (2007)
- Sallybright (2007)
- Cassandra (2007)
- Viktoria (2008)
- Sasha (2009)
- Lucy (2009)
- Elegance (2009)
- Fenella (2009)
- Finesse (2009)
- Cupid (2010)
- Irresistible (2010)
- Sweetheart (2010)
- Vibrant (2011)
- Mayflower (2012)
- Serenity (2012)
- Buddy (2012)
- Strawnino (2013)
- Malling™ Centenary (2013)
- Malling™ Star (2014)
- Malling™ Beauty (2014)
- Malling™ Glow (2014)
- Malling™ Silk (2014)
- Malling™ Sunrise (2014)
- Malling™ Allure (2018)
- Malling™ Champion (2018)

1 Amateur varieties, 2 Exclusive varieties

Plant Science into Practice
Partners

SOLO BERRY
MACK
Berry World Varieties
AHDB
Berry Gardens

Plant Science into Practice
Selecting Resistance screening Growers Trials

Propagation Preliminary Trials Knowledge Transfer

‘cross to cultivar’ 8 years

Crosses Resistance screening

Growers Trials Propagation Commercialisation

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Research Projects

Crosses
Resistance screening

Selecting

Trialling

Knowledge Transfer

Commercialisation

Growers Trials

Propagation

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Breeding Target: Fruit Size

Elsanta
Malling Centenary

% large fruit (>35mm)

Plant Science into Practice
Genetic improvement of strawberry for sustainable production in the UK Project HH3201SSF
Breeding Target: Disease Resistance

Improved disease resistance in strawberry (IDRIS) 2013-18. Value £1.1million

Emily x Fenella

181 progeny

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>Actual Crown Rot</th>
<th>Predicted Crown Rot</th>
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<tbody>
<tr>
<td>1</td>
<td>4.4</td>
<td>3.66</td>
</tr>
<tr>
<td>2</td>
<td>5.79</td>
<td>5.73</td>
</tr>
<tr>
<td>3</td>
<td>3.95</td>
<td>3.24</td>
</tr>
<tr>
<td>4</td>
<td>3.2</td>
<td>4.15</td>
</tr>
<tr>
<td>5</td>
<td>5.27</td>
<td>6.23</td>
</tr>
<tr>
<td>6</td>
<td>4.73</td>
<td>5.71</td>
</tr>
<tr>
<td>7</td>
<td>4.2</td>
<td>3.24</td>
</tr>
<tr>
<td>8</td>
<td>6.11</td>
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<tr>
<td>EM2464</td>
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<td>13</td>
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<td>3.73</td>
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<tr>
<td>14</td>
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<td>3.13</td>
</tr>
<tr>
<td>15</td>
<td>N/A</td>
<td>3.73</td>
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<td>2.08</td>
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<td>EMR564</td>
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<td>EMR639</td>
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<td>2.08</td>
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<tr>
<td>17</td>
<td>4.00</td>
<td>3.24</td>
</tr>
<tr>
<td>18</td>
<td>4.00</td>
<td>3.66</td>
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<td>19</td>
<td>N/A</td>
<td>3.66</td>
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<tr>
<td>EMR704</td>
<td>2.95</td>
<td>3.24</td>
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Plant Science into Practice
Malling™ Centenary

Plant Science into Practice
### Picking efficiency

<table>
<thead>
<tr>
<th>30% saving</th>
<th>Class 1 Yield (t/ha)</th>
<th>Waste</th>
<th>Picking cost (€/kg)</th>
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<tbody>
<tr>
<td>Elsanta</td>
<td>27.4</td>
<td>15%</td>
<td>0.64</td>
</tr>
<tr>
<td>M Centenary</td>
<td>27.1</td>
<td>&lt;1%</td>
<td>0.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.8x faster</th>
<th>2016 (kgs/hr)</th>
<th>w/c 23 May 16 (kgs/hr)</th>
<th>Fastest 3 pickers (kgs/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrant</td>
<td>8.9</td>
<td>9.9</td>
<td>16.0</td>
</tr>
<tr>
<td>M Centenary</td>
<td>15.9</td>
<td>18.9</td>
<td>27.9</td>
</tr>
</tbody>
</table>

*Source: BerryGardens Commercial Grower site, Cambs, United Kingdom. 2016*
Glasshouse production

Data courtesy of Haygrove, UK
Grower recommendations

• **Plant establishment**
  – Be wary of rapid, strong growth as roots system weaker and less fibrous
  – Summer planting: problems with tip and calyx burn, boost root pressure
  – Remove pre-flower (flowers expressed within 5000 GDH of planting)
  – Avoid overhead sprinkling

• **Plant management**
  – High crown density good, avoid crown thinning (if is needed then do immediately after harvest)
  – BUT botrytis risk ↑, so remove short leaves around crowns and pull trusses & beware moisture trapped in more upright flowers
  – Long trusses, truss tape moved up and out compared to Elsanta
Grower recommendations

- **Chill requirement & manipulation**
  - High, similar to Sonata, overwintered glass may require night-break lighting to get stretch
  - Partly chilled (600-800) + night break lighting (30-40 nights) can achieve useful, high-quality summer crop with little gap in picking

- **Nutrition**
  - To avoid tip burn, high calcium starter feed
  - Potassium demand during early fruiting stage, but needs to be reduced around 65% pick to avoid calyx burn on developing crop
  - Avoid starving plants that are to be overwintered, can lose vigour and go into premature flower induction
Crop Protection

**Crown rot** (*Phytophthora cactorum*) susceptible
- Plant quality is key – check propagation, inspect in production fields
- Promptly remove any collapsing plants
- Use fresh substrate
- Avoid overhead irrigation
- Apply fungicides at plant establishment, also try Potassium Phosphite
- Avoid operations to cause any crown damage
- Avoid overwatering
<table>
<thead>
<tr>
<th>Short-day</th>
<th>V Early</th>
<th>Early</th>
<th>Mid</th>
<th>Mid-late</th>
<th>Late</th>
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<tbody>
<tr>
<td>Standard</td>
<td>Flair</td>
<td>Clery/Lusa</td>
<td>M Cent</td>
<td>Sonata</td>
<td>Faith</td>
</tr>
<tr>
<td>2019/20</td>
<td></td>
<td>EM2464 (LS)</td>
<td>EM2248</td>
<td>EM2494</td>
<td>M Allure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EM2541</td>
<td></td>
<td></td>
<td>EM2434</td>
</tr>
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<td></td>
<td></td>
<td>EM2544</td>
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<td>EM2588</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EM2622</td>
</tr>
<tr>
<td>2020/21</td>
<td>EM2547 (LS)</td>
<td>EM2628</td>
<td>EM2591</td>
<td>EM2617</td>
<td>EM2628</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EM2696</td>
<td></td>
<td></td>
<td>EM2656</td>
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<td></td>
<td></td>
<td>EM2721</td>
<td></td>
<td></td>
<td>EM2674</td>
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</table>

<table>
<thead>
<tr>
<th>Everbearer</th>
<th>Early</th>
<th>Mid</th>
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<tbody>
<tr>
<td>Standard</td>
<td>M Champion</td>
<td>Murano</td>
</tr>
<tr>
<td>2019</td>
<td>EMR704 (LS)</td>
<td>EMR693 (LS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EMR773</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EMR794</td>
</tr>
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<td></td>
<td></td>
<td>EMR797</td>
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<tr>
<td>2020</td>
<td>EMR721 (LS)</td>
<td>EMR745</td>
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<tr>
<td></td>
<td>EMR727</td>
<td>EMR805</td>
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<td></td>
<td>EMR796 (LS)</td>
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</table>
• Late season June-bearer
• High % Class 1 (>90%)
• Large fruit size (>65% >35mm)
• Good yield potential (c1kg/plant)
• Excellent fruit quality
• Excellent display
• Moderate plant vigour
• “Late Malling Centenary”

Figure 1. Class 1 yields and fruit size, NIAB-EMR trial 2016. Misted tips, tunnelled soil production.
Kent, 2017

Perth, 2017

Source: 2017 Berry Gardens trial site data
Malling™ Allure

2016 Maincrop Size

<table>
<thead>
<tr>
<th>Class 1 Yield (g/plant)</th>
<th>EM2157</th>
<th>Elsanta</th>
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</thead>
<tbody>
<tr>
<td>&gt;35mm</td>
<td>800</td>
<td>600</td>
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<tr>
<td>28-35mm</td>
<td>400</td>
<td>200</td>
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</table>

Sonata

Malling™ Centenary

Malling™ Allure

Plant Science into Practice
Plant Science into Practice
Malling™ Champion

- Early everbearer
- High % Class 1 (>85%)
- Good fruit size (>60% >35mm EMSBC trials)
- Good yield potential (c1kg/plant)
- Excellent shelf life, firm flesh, strong skin, maintains colour
- Juicy texture
- Compact plants
- Strong, long trusses
- Excellent disease resistance
Malling™ Champion

Plant Science into Practice
Malling™ Champion

Score: 81.9%

- 1st, overall assessment
- 1st, firmness
- 2nd, shelf life
- 2nd, transport tests
• Early – mid season June-bearer
• High % Class 1 (96%)
• Good fruit size (>60% >35mm)
• Yield comparable to M Centenary
• Excellent shelf life
• Good plant habit & fruit display
• Resistance to crown rot
• Commercialisation in 2019

<table>
<thead>
<tr>
<th></th>
<th>Class 1 yield (g/plant)</th>
<th>% large (&gt;35 mm)</th>
<th>% Class 1</th>
<th>50% HD</th>
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</thead>
<tbody>
<tr>
<td>EM2464</td>
<td>683</td>
<td>60</td>
<td>96</td>
<td>16-Jun</td>
</tr>
<tr>
<td>Vibrant</td>
<td>668</td>
<td>54</td>
<td>94</td>
<td>20-Jun</td>
</tr>
<tr>
<td>M Cent</td>
<td>676</td>
<td>63</td>
<td>92</td>
<td>20-Jun</td>
</tr>
</tbody>
</table>

**Plant Science into Practice**
- Very early season June-bearer
- High % Class 1 (88%)
- Large fruit size (>88% >35mm)
- Excellent fruit quality (frim)
- High brix (avg. 9.1°)
- Growers’ trials 2020/21
High yielding new selections

**EM2434**
- Short-day
- 2.5kg/plant (2016)
- 78% >35mm
- Mean brix 9.4º

**EMR773**
- Everbearer
- 1.7kg/plant (2017)
- 81% >35mm!
- Mean brix 8.1º
Everbearer EMR796

Plant Science into Practice
Future Developments

Breeding efficiency

New Molecular Genetic Tools

New Territories

New pest & diseases

Land use, population growing systems

Environmental Requirements

Labour requirements/Automation

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