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Project leader:	Adam Whitehouse
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Key workers:	Dr David Simpson Kirsty Hammond Andy Passey Abigail Johnson
Location:	East Malling Research New Road East Malling West Malling, Kent ME19 6BJ
Project Co-ordinator:	Mr Andrew Chesson Manor Farm Oldbury Borough Green, Kent TN15 9DG
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AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

Adam Whitehouse
Plant Breeder
East Malling Research

Signature…… Date .....

David Simpson
Research Team Leader
East Malling Research

Signature…… Date .....

Report authorised by:

Christopher Atkinson
Head of Science
East Malling Research

Signature…… Date .....

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Grower summary

Headline

Four new cultivars suitable for growing in the UK over an extended season have been released, with a further two cultivars expected to be released in 2007/08. Thirty-six selections have been selected to go forward to grower trials based on their performance in preliminary trials.

Background and expected deliverables

The strawberry breeding programme at East Malling Research (EMR) is developing new cultivars for all sectors of the strawberry industry in the UK. The programme receives funding from both the public and private sector.

It is the intention of the breeding programme to release new cultivars which show some advantage over those currently available for a particular purpose or slot in the season. This advantage may be in terms of:

- fruit quality
- yield
- resistance to pests or diseases (to minimise pesticide applications),
- fruit size and presentation for picking
- a combination of these characters

The aim of this project was to perform preliminary trials to screen selections for the criteria above and identify those that should go forward for assessment on large scale, farm-based trials (funded by Meiosis Ltd and HDC project SF40d).

Summary of the project and main conclusions

- A total of 228 June-bearer selections and 45 everbearer selections from the East Malling breeding programme were evaluated to determine which should undergo further trialling

- Thirty-one June-bearer selections and five everbearer selections were chosen to progress for further trialling

- Nine selections are now in advanced, large-scale grower trials and decisions on release will be taken during 2007 and 2008

- Seven selections are in grower trials, planted in 2006

- Twenty-four selections are being propagated for planting in grower trials in 2007 or 2008

- Four cultivars have been released between 2004 and 2006:

    - **'Delia'** (EM0835) was launched in 2005 as in grower trials it had proved popular with a number of northern based growers with supermarket outlets
    - **'Judibell'** (EM0965) is an exceptionally late June-bearer that is establishing a niche for PYO and direct sales in the second half of July
    - **'Malling Pearl'** (EMR286) was widely planted in 2005/2006 and has potential for all markets in the UK
    - **'Malling Opal**' (EMR287) is establishing a niche as an early season, everbearing cultivar for PYO and direct sales

- Two cultivars are scheduled to be released in 2007/2008:

    - **'Amelia'** (EM1103), has a late season with attractive regular-shaped berries. Its later season, improved shelf-life and colour make it well placed to become a possible 'Florence' replacement
    - **'Lucy'** (EM0931), is slightly later than 'Elsanta'. It is notable for its large fruit size, high yield and attractive, bright mid-red colour. It grows well on low input systems and has potential for PYO and possibly some supermarket outlets

Financial benefits

- Cultivars and selections with improved fruit size and display combined with low percentage waste will lead to reduced picking costs
- Extension of the growing season using early and late season cultivars, such as 'Delia' and 'Judibell', will allow growers to produce fruit economically during periods when demand is high
- Improved disease resistance, as demonstrated by 'Judibell' and the advanced selection EM1108, allows production with reduced pesticide applications.
- Propagators will benefit through the opportunity to produce the plants of these cultivars to satisfy demand from the UK and overseas

Action points for growers

- 'Delia' offers growers the opportunity to start the season with a productive variety that has a very attractive appearance, excellent shelf-life and crops approximately one week earlier than 'Elsanta'

- 'Judibell' offers a very late season, grower-friendly cultivar for PYO and direct sales

- 'Malling Pearl' offers a supermarket grower an alternative to 'Everest', with better colour, larger fruit size, higher sugars and superior eating quality. Precautions should be taken against infection with crown rot

- 'Malling Opal' is similar in many ways to 'Malling Pearl' and, although yield and berry size is larger, the inferior firmness makes it more suitable for PYO and direct sales

- Selections identified in preliminary trials as being suitable for growers' trials will, in due course, be available from Meiosis Ltd to trial in small quantities. Interested growers should contact the Meiosis Trials Officer, Sarah Troop (Meiosis Ltd, Bradbourne House, Stable Block, East Malling, West Malling, Kent, ME19 6DZ)

Science section

INTRODUCTION

The strawberry breeding programme at East Malling Research (EMR) aims to produce new varieties for all sectors of the United Kingdom strawberry industry. It has been successful in releasing 20 new cultivars between 1988 and 2005. The programme receives funding from four main sources: Department of Environment, Food and Rural Affairs (Defra) for strategic underpinning research, Meiosis Ltd for variety development, Horticultural Development Council (HDC) for all aspects of variety trialling and East Malling Trust for Horticultural Research (EMTHR) for disease screening.

It is the intention of the EMR breeding programme to release new cultivars which show some advantage over those currently available for a particular purpose or slot in the season. Particular emphasis is placed on improving fruit quality, yield, resistance to pests or diseases (to minimise pesticide applications), fruit size and presentation for picking, or any combination of these characters.

Preliminary trials are used to screen selections for those that display the desirable traits listed above and identify those that should go forward for assessment on large scale, farm-based trials (funded by Meiosis Ltd and HDC project SF 40d).

The industry will benefit from the future releases of new strawberry cultivars that are adapted for UK production systems and with fruit quality suited to UK markets.

METHODS AND TRIAL DESIGN

1. June-bearer trials

During each year of the project, a trial was planted in the last week of July or the first week of August on a trial plot at East Malling Research. Plants were propagated as misted tips and planted in 10-plant plots on raised beds with opaque polythene mulch and trickle irrigation. These plots were covered by polythene clad tunnels from the end of May, for rain protection only, and netted to protect against bird damage. Each trial was maintained for a single cropping season and a standard commercial spray programme was used to control pests and diseases.

Each trial comprised 50-110 new June-bearer lines from the East Malling breeding programme, approximately 10 advanced selections (which had also progressed to grower trials) and a variable number of cultivars or selections from overseas. ‘Elsanta’ was used as a standard cultivar and other standards were chosen as appropriate for each trial – these included ‘Christine’, ‘Florence’, ‘Rosie’ and ‘Symphony’. New selections and untested foreign cultivars or selections were planted in a single 10-plant plot but advanced selections were replicated in two blocks, using a randomised design. There were three replicate plots of ‘Elsanta’ and two of the other standard cultivars. At the end of the first season, any selections that were clearly inferior to the appropriate standard cultivar were discounted for inclusion in the 60-day trial. The remaining selections were propagated, as described below, for inclusion in a 60-day trial.

2. 60-day trials

Plants were propagated in nursery beds established at the end of July by ‘pinning-down’ primary and secondary runners from main crop (June-bearer) trial plants that had finished fruiting. Runners were lifted and graded in December and stored at -2°C until planting. Single-crowned plants with crown diameter measurements within the median range of those measured for each selection were chosen as trial plants. The trial was planted during the third or fourth week of May and covered by polythene clad tunnels for rain protection and netting for bird protection. Each trial was maintained for a single cropping season and a standard commercial spray programme was used to control pests and diseases.

Each trial comprised 20-40 new June-bearing lines from the East Malling breeding programme, approximately 10 advanced selections (which had also progressed to grower trials) and a variable number of cultivars or selections from overseas. ‘Elsanta’ was used as a standard cultivar and other standards were chosen as appropriate for each trial – these included ‘Florence’ and ‘Symphony’. New selections and untested foreign lines or cultivars were planted in a single 10-plant plot but advanced selections were replicated in two blocks, using a randomised design. There were up to three replicate plots of ‘Elsanta’ and a single plot of the other standard cultivars.

3. Everbearer trials

During each year of the project, plants were propagated as misted tips at the end of July, potted on after 8 weeks into 9cm pots and then over-wintered in a polythene clad tunnel. Each trial was planted during the first or second week of April of the following year and planted in 10-plant plots on raised beds with opaque polythene mulch and trickle irrigation. These plots were covered by polythene clad tunnels for rain protection and netting for bird protection. Each trial was maintained for a single cropping season and a standard commercial spray programme was used to control pests and diseases.

Each trial comprised 10-20 new everbearing lines from the East Malling breeding programme, 0-3 advanced selections (which had also progressed to grower trials) and a variable number of cultivars or selections from overseas. ‘Everest’ was used as a standard cultivar and other standards were chosen as appropriate for each trial – these included ‘Bolero’ and ‘Diamante’. New selections and untested foreign lines or cultivars were planted in a single 10-plant plot but advanced selections and standards were replicated in two blocks, using a randomised design.

4. Fruit and plant assessments

Each trial was harvested twice weekly, on Mondays and Thursdays, and the fruit was graded by the pickers into four categories:

- Class 1 >35 mm
- Class 1 25-35mm
- Class 1 <25mm
- Class 2 and unmarketable

At each harvest, the quality of the fruit was evaluated by a panel of experienced breeders. Using subjective 9-point scales, a score was given for appearance, skin and flesh firmness, flavour and an overall comparison with the standard (selection index). For the promising selections, samples of 15 berries were taken at a minimum of three harvests and placed in a controlled environment cabinet for four days at 18°C. The samples were then assessed for deterioration in comparison with the standards. Brix measurements were also taken from fresh berries of the promising selections on at least three occasions per season. The vegetative characteristics of the plants were recorded once per season and any disease

symptoms were noted.

All data were recorded in a Microsoft Access database. Analysis procedures were developed to produce summary tables showing the relative performance of lines in each trial and to provide a detailed record for each selection.

TRIALS COMPLETED

1. June-bearer trials

During the course of the project, three trials were assessed (Table 1). A total of 228 new selections from the East Malling breeding programme were evaluated, along with six overseas cultivars and two numbered selections from Italy. Recycled selections had previously been trialled but were replanted as replicated plots to confirm the previous trial data. The average number of lines assessed in each trial was 94.

Table 1. Germplasm evaluated from 2004 to 2006

Trial	New selections	Recycled Selections	Advanced selections	Overseas cultivars	Overseas selections	Total
2004	49	9	5	3	1	67
2005	70	13	2	3	1	89
2006	109	6	10	0	0	125
Totals	228	28	17	6	2	

2. 60-day trials

During the course of the project, three trials were assessed (Table 2). A total of 94 new selections from the East Malling breeding programme, along with four overseas cultivars were evaluated all of which had previously been assessed in the main crop trial. The average number of lines assessed in each trial was 45.

Table 2. Germplasm evaluated from 2004 to 2006

Trial	New selections	Recycled selections	Advanced selections	Overseas cultivars	Overseas selections	Total
2004	41	7	2	1	0	51
2005	24	9	5	2	0	40
2006	29	13	1	1	0	44
Totals	94	29	8	4	0	

3. Everbearer trials

During the course of the project three trials were assessed (Table 3). A total of 45 new selections from the East Malling breeding programme were evaluated, along with one overseas cultivar. The average number of lines assessed in each trial was 18.

Table 3. Germplasm evaluated from 2004 to 2006

Trial	New selections	Recycled selections	Advanced selections	Overseas cultivars	Overseas selections	Total
2004	10	2	2	0	0	14
2005	20	2	0	0	0	22
2006	15	0	1	1	0	17
Totals	45	4	3	1	0	

4. Outputs

During the course of the project, 36 new selections (31 June-bearers and five everbearers) have been chosen for further trials based on their performance in East Malling trials (Table 4). In addition, 36 recycled and advanced selections (34 June-bearers and 2 everbearers) have been re-trialled (Table 5). Brief descriptions for each of these selections are in sections 4.1-4.4. In many cases these further trials are in progress and selections are still under consideration. Decisions on releasing new cultivars will be taken when advanced and grower trials have been completed.

Four cultivars have been named and released for use by commercial growers in the UK with a further five scheduled to be released in 2007 or 2008. The breeders' descriptions for the released cultivars are included in Appendix 1. Six of these cultivars are or will be available for all UK nurseries to propagate (under licence from Meiosis Ltd.). In addition three niche cultivars will be released on exclusive contracts; 'Sallybright' (EM1296) and EM1294 (not yet assigned a name) will be marketed exclusively by Suttons and Thomson and Morgan respectively for the amateur market, and 'Cassandra' (EM1064) will be licensed exclusively to Vissers of The Netherlands. EM1064 was trialled extensively in the UK but the fruit quality was not considered suitable for the domestic market.

Brief descriptions follow for the cultivars available to commercial growers in the UK:

'Amelia' (proposed release in 2007) is a late season June-bearer, approximately 10 days later than 'Elsanta'. Good yield of attractive, regular-shaped berries which show good firmness and have a mid red colour. Shelf-life and Brix superior to 'Elsanta'. Plants are rather dense but fruit is well-displayed. Susceptible to *Verticillium* wilt but moderately resistant to both powdery mildew and crown rot. Trialled as EM1103.

'Delia' (2005 release) is an early variety, up to one week earlier than 'Elsanta'. Yield is similar to 'Elsanta' but with larger average fruit size. The berries are very attractive with a bright orange- red colour and glossy skin finish. The shape is very regular conical and eating quality is similar to 'Honeoye', juicy but slightly acidic. Shelf-life is very good, due to the bright colour and good firmness. Plants have moderate vigour with upright habit and the fruit is well displayed allowing for rapid harvesting. In trials, 'Delia' has performed better when established from a misted tip rather than as a 60-day plant. It does not have strong resistance to any of the common strawberry diseases and should be treated as 'Elsanta' for disease and pest control. 'Delia' offers growers the opportunity to start the season with a productive variety that has a very attractive appearance, excellent shelf-life and crops one week earlier than 'Elsanta'. Trialled as EM835.

'Judibell' (2005 release) is an exceptionally late season June-bearer, being significantly later than all other June-bearing varieties, including 'Pandora' and 'Sophie'. At East Malling the crop is actually produced in July and early August outdoors, the 50% pick date being some five weeks later than 'Elsanta'. An additional benefit is that 'Judibell' has good tolerance to *Verticillium* wilt, crown rot and powdery mildew, similar to 'Florence'. Trialled as EM965.

'Lucy' (proposed release in 2008) is up to 7 days later than 'Elsanta', with a season similar to 'Symphony'. Noted for its large fruit size, high yield and attractive bright mid-red colour, with shelf-life similar to 'Elsanta'. Plants are quite vigorous, but the fruit is well-displayed. Susceptible to both *Verticillium* wilt and powdery mildew, but moderately resistant to crown rot. Trialled as EM0931.

'Malling Pearl' (2005 release) is a large fruited, everbearer variety with a similar season to 'Everest'. The berries have a conical shape and attractive appearance with mid-red colour. The fruit is firm with a uniform shape. Berries have a juicy texture and sweet, well balanced flavour with excellent shelf-life. Plants have similar vigour to 'Everest', but runner production is

greater and it is important to remove the runners regularly to maximise yield. Plants are susceptible to crown rot and *Verticillium* wilt but moderately resistant to powdery mildew. It is suited to all market outlets and sampling to supermarkets has already confirmed its appeal to this sector. It offers supermarket growers a real alternative to 'Everest', with better colour, larger fruit size, higher sugars and superior eating quality. Trialled as EMR286.

'Malling Opal' (2005 release) is an early season everbearer variety with a similar season to 'Everest'. The berries are moderately firm with a conical shape, mid-red colour and slightly raised seeds. Plants are more productive than 'Everest' with larger average fruit size. Eating quality is excellent, with a juicy texture and sweet flavour. Shelf-life is fair but requires careful handling during periods of hot weather in order to avoid bruising. Plants have similar vigour to 'Everest', but runner production is greater and it is important to remove the runners regularly to maximise yield. Plants are susceptible to crown rot and *Verticillium* wilt but moderately resistant to powdery mildew. 'Malling Opal' is suitable for PYO, direct sales and the amateur market. Trialled as EMR287.

Table 4. Selections chosen for further trialling during the course of the project

Selection	Year in main crop trial	Year in 60-day trial	Current status
EM1262	2004/2006	2005	Grower trials 2006/2007
EM1280	2004	2005	Grower trials 2006/2007
EM1282	2006	2004	Grower trials 2008/2009
EM1308	2004/2006	2005	Grower trials 2006/2007
EM1371	2004/2006	2005	Grower trials 2006/2007
EM1395	2004/2006	2005	Grower trials 2006/2007
EM1396	2004/2006	2005	Grower trials 2006/2007
EM1398	2004/2006	2005	Grower trials 2006/2007
EM1399	2005	2006	Grower trials 2007/2008
EM1442	2005	2006	Grower trials 2007/2008
EM1445	2005	2006	Grower trials 2007/2008
EM1453	2005	-	Grower trials 2007/2008
EM1470	2006	-	Grower trials 2008/2009
EM1480	2006	-	Grower trials 2008/2009
EM1492	2005	2006	Grower trials 2007/2008
EM1500	2005	2006	Grower trials 2007/2008
EM1502	2005	2006	Grower trials 2007/2008
EM1506	2005	2006	Grower trials 2007/2008
EM1523	2005	2006	Grower trials 2007/2008
EM1526	2005	2006	Grower trials 2007/2008
EM1552	2006	-	Grower trials 2008/2009
EM1572	2006	-	Grower trials 2008/2009
EM1580	2006	-	Grower trials 2008/2009
EM1589	2006	-	Grower trials 2008/2009
EM1592	2006	-	Grower trials 2008/2009
EM1597	2006	-	Grower trials 2008/2009
EM1599	2006	-	Grower trials 2008/2009
EM1607	2006	-	Grower trials 2008/2009
EM1624	2006	-	Grower trials 2008/2009
EM1628	2006	-	Grower trials 2008/2009
EM1636	2006	-	Grower trials 2008/2009
EMR346	2005	n/a†	Grower trials 2007/2008
EMR349	2005	n/a†	Grower trials 2007/2008
EMR370	2006	n/a†	Grower trials 2008/2009
EMR376	2006	n/a†	Grower trials 2008/2009
EMR386	2006	n/a†	Grower trials 2008/2009

† EMR selections are everbearers so are not included in the 60-day trial

Table 5. Selections that were recycled or trialled as advanced selections during the course of the project

Selection	Years in main crop trial	Year in 60-day trial	Current status
EM0835	2004	2005	Named 'Delia'
EM0931	2004/2006	2005	Proposed name 'Lucy'
EM0933		2004	Meiosis trials
EM0934		2004	Meiosis trials
EM0965	2004	2005	Named 'Judibell'
EM0972	2004	2005	Meiosis trials
EM1024	2004	2005	Meiosis trials
EM1064	2006		Proposed name 'Cassandra'[1]
EM1072	2006	2004	Trials in Holland/France/Spain
EM1103A	2006		Proposed name 'Amelia'
EM1108	2006	2004	Advanced trials
EM1119	2006	2004	Advanced trials
EM1128	2004	2005	Meiosis trials
EM1144	2004	2005	Advanced trials
EM1148	2006	2004	Advanced trials
EM1159	2006	2004	Advanced trials
EM1161		2004	Meiosis trials
EM1211	2004	2005	Meiosis trials
EM1228	2004	2005	Meiosis trials
EM1231	2004/2005	2004/2005	Meiosis trials
EM1232	2004/2005	2005/2006	Advanced trials
EM1235	2005	2004/2006	Meiosis trials
EM1246	2004/2005	2005/2006	Meiosis trials
EM1248	2004/2005	2004/2005	Meiosis trials
EM1259	2004/2005	2005/2006	Advanced trials
EM1265	2005	2006	Meiosis trials
EM1276	2005	2004/2006	Advanced trials
EM1281	2005	2004/2006	Meiosis trials
EM1294	2005/2006	2004/2006	To be released. No name yet assigned[2]
EM1296	2005/2006	2004/2006	Named 'Sallybright'[3]
EM1315		2004	Advanced trials
EM1319	2005	2004/2006	Meiosis trials
EM1324	2005	2004/2006	Meiosis trials
EM1326	2005	2004/2006	Meiosis trials
EMR214	2004	n/a	Meiosis trials
EMR255	2004/2006	n/a	Meiosis trials
EMR286	2004/2005/2006	n/a	Named 'Malling Pearl'
EMR287	2004/2005/2006	n/a	Named 'Malling Opal'

[1] Licensed to Vissers of The Netherlands
[2] Marketed exclusively by Thompson & Morgan for the amateur market
[3] Marketed exclusively by Suttons for the amateur market

4.1. Selections in advanced trials

EM1108. A mid-season selection with good yield, good fruit size with very high percentage class 1 fruit. Attractive, firm berries with good colour and regular shape. Good shelf-life. Plants have good resistance to *Verticillium* wilt but are very vigorous on clean land. Upright habit, similar to'Florence'. Probably too vigorous for tunnels but would be suited to less intensive production systems. Further main crop results expected in 2007.

EM1119. One week earlier than 'Elsanta' with high yield and good fruit size. Berries are glossy and uniform but darker than 'Elsanta' and slightly more prone to bruising. Shelf-life and Brix similar to 'Elsanta'. Very erect plants which are taller than 'Elsanta' and with very long trusses. If mowed off after harvest this selection will produce a second crop in autumn. Moderately resistant to powdery mildew but susceptible to *Verticillium* wilt. Suited to glasshouse and substrate production. Further main crop results expected in 2007.

EM1144. A mid-season selection with very good yield and fruit size. Glossy berries that were rather dark in East Malling trials leading to slightly inferior shelf-life compared with 'Elsanta'. Flavour during grower trials was judged to have a good acid to sugar balance, scoring similar to 'Elsanta'. Plants have erect habit and similar vigour to 'Elsanta' but with better fruit display. Moderately susceptible to *Verticillium* wilt and susceptible to powdery mildew. A good all round performer that was liked by supermarket technologists during the 2005 growers' main crop trial. Further main crop results expected in 2007 which will determine its potential as a competitor to 'Elsanta'.

EM1148. A mid-season selection with similar yield to 'Elsanta' but much better fruit size and higher percentage class 1. Firm, glossy berries with regular shape and good flavour. Brix and shelf-life similar to 'Elsanta'. Plants have erect habit and are more vigorous than 'Elsanta' but fruit is well displayed. Intermediate resistance to *Verticillium* wilt but appeared to be susceptible to powdery mildew on growers' trials. Further main crop results expected in 2007.

EM1159. One week later than 'Elsanta'. Very high yield and large average fruit size with high percentage class 1 fruit. Attractive berries with regular shape, good colour and flavour. Shelf-life and Brix similar to 'Elsanta'. Quite vigorous plants with erect habit, but susceptible to *Verticillium* wilt and powdery mildew. Grower trials confirmed the excellent yield and long picking period of this selection. It has performed particularly well in substrate production in

both tunnels and glasshouses and is suitable to all market outlets. Further main crop results expected in 2007.

EM1232. A mid-season selection with good yield and fruit size. Very attractive, firm berries with good shape and colour but variable flavour, sometimes acidic. Shelf-life better than 'Elsanta' but lower average Brix. Plants have moderate vigour and erect habit, but are susceptible to powdery mildew and *Verticillium* wilt. Shape, colour, firmness and texture were liked by supermarket technologists so recommended for inclusion in advanced trials 2007/08.

EM1259. An early season selection. Only moderate yield and fruit size but a lot of flowers were lost due to frost in the East Malling trial. Attractive, heart-shaped berries with good colour and consistently good flavour. Shelf-life and Brix better than 'Elsanta'. Plants have erect habit and are slightly more vigorous than Alice. Some susceptibility to powdery mildew and moderately susceptible to *Verticillium* wilt. Liked by supermarket technologists and recommended for inclusion in advanced trials 2007/08

EM1276. Similar season to 'Symphony'. Higher yield than 'Florence' and 'Symphony' with very good fruit size. Attractive, glossy berries with good shape and colour. Flavour scores similar to 'Elsanta' but shelf-life was superior. Plants are more vigorous than 'Elsanta' and very tall but also very erect. Susceptible to powdery mildew but moderately resistant to *Verticillium* wilt and crown rot. Performed exceptionally well in 60-day production trials. It has the potential to become a named cultivar. Further main crop results expected in 2007.

EM1315. A mid-season selection with very good yield and fruit size through the season. Attractive, firm, glossy berries with orange-red colour and better shelf-life than 'Elsanta'. Flavour a bit variable, sometimes acidic. Plants had moderate vigour but a bit taller than 'Elsanta'. Shows resistance to *Verticillium* wilt and crown rot. May compete favourably with 'Elsanta' in both 60-day and main crop production. Recommended for advanced trials 2007/2008.

4.2. Selections planted in grower trials in 2006

EM1262. A mid-season selection. High yield but average fruit size smaller than 'Elsanta'. Glossy, firm berries with good colour and good shelf-life. Flavour scores were similar to 'Elsanta'. Plants are compact but quite dense, although fruit is well displayed.

EM1280. A mid-season selection. Very good fruit size but yield less than 'Elsanta'. Very attractive, firm, glossy berries with good shape and colour. Flavour scores similar to 'Elsanta' but better shelf-life.

EM1308. Mid-season but slightly later than 'Elsanta'. High yield and large fruit size. Berries are firm and glossy with good colour but a large calyx. Good shelf-life and average flavour scores slightly were better than 'Elsanta'. Plants are compact but quite dense.

EM1371. Mid-season. Yield and fruit size slightly better than 'Elsanta' and high percentage class 1. Moderately firm with good shape and colour but large reflexed calyx. Shelf-life similar to 'Elsanta' and flavour slightly better on average. Plants are very erect and quite dense.

EM1395. Season intermediate between 'Symphony' and 'Florence'. Yield lower than 'Florence' but very high percentage class 1 and much better appearance. Uniform, firm, glossy berries with good shape and colour. Flavour scores were very similar to 'Elsanta' but better shelf-life. Plants are more vigorous than 'Elsanta' and a bit dense.

EM1396. Mid-season. Yield lower than 'Elsanta' but plants are smaller. Very attractive, glossy, firm berries with good colour. Flavour slightly better than 'Elsanta' on average and excellent shelf-life. Plants are compact and may be well suited for substrate culture.

EM1398. Same season as 'Symphony'. Good yield and fruit size with high percentage class 1. Attractive, glossy, firm berries with pale colour and good shelf-life. Flavour scores were similar to 'Elsanta'. Plants are vigorous, like 'Florence'.

4.3. Selections to be planted in grower trials in 2007

EM1399. A mid-season selection. High yield with good size fruit and high percentage class 1. Attractive, glossy berries with good colour and firmness but only average flavour, sometimes quite weak. Plants are quite vigorous but with very erect habit.

EM1442. An early season selection, about 3 days before 'Elsanta' for 50% harvest. Started cropping slightly later than 'Christine' but had same 50% pick date and much higher yield. High percentage class1, good all-round quality and good shelf-life. Nice plants with moderate vigour.

EM1445. Early season, about 3 days before ‘Elsanta’ for 50% harvest. Started cropping slightly later than ‘Christine’ but had same 50% pick date and very high yield. High percentage class 1 yield and attractive, firm berries. Average flavour, sometimes bland.

EM1453. A mid-season selection. Exceptionally high yield and high percentage class 1. Attractive, glossy berries but darker than ‘Elsanta’ and primary berries are sometimes a bit irregular. Firm with good shelf-life. Plants had similar vigour to ‘Elsanta’ and very good display.

EM1492. A late season selection. Season about one week later than ‘Symphony’. High yield and large fruit size. Irregular shape on first harvest but improved afterwards. Firm with good colour but shelf-life inferior to ‘Elsanta’. Large calyx. Flavour variable but quite high Brix. Moderately vigorous plants, not too dense.

EM1500. Late season. Ten days later than ‘Symphony’ for 50% harvest and with a long season. Very high yield and large fruit size. Irregular primaries on first harvest but otherwise good shape and pale colour. Skin sometimes fragile and shelf-life inferior to ‘Elsanta’. Fairly vigorous plants and quite dense.

EM1502. Late season. Similar season to ‘Symphony’ but with a flatter cropping profile. Yield and fruit size similar to ‘Symphony’. Pale coloured, glossy berries with rather uneven ripening (on white polythene). Firm with good shelf-life. Average flavour. Plants are compact with a very sparse habit.

EM1506. Late season. Similar season to ‘Symphony’ but with a flatter cropping profile. High yield, large berries and very high percentage class 1. Firm berries with good colour and fair shelf-life. Fairly vigorous plants with big leaves.

EM1523. Late season. Similar season to ‘Symphony’ but with a flatter cropping profile. Good yield and fruit size. Very glossy berries with sunken seeds and fairly variable shape. Darker colour than ‘Elsanta’ but similar performance in shelf-life tests. Pleasant flavour and average Brix similar to ‘Elsanta’. Plants are compact but quite dense.

EM1526. Mid-season. Good yield and fruit size with high percentage class 1. Firm, glossy berries with pale colour and slightly uneven ripening (on white polythene mulch). Flavour

sometimes acidic. Shelf-life similar to 'Elsanta'. Variable vigour but plants are quite dense.

EMR346. Everbearer. Very attractive, uniform-shaped berries that were well-displayed on long trusses, and gave a similar yield to 'Everest' but with larger fruit size. Flavour was judged to have a good sugar-acid balance. Berries retained their gloss during shelf-life, giving slightly better overall score compared to 'Everest'. Cropping season was similar to 'Everest' although the cropping profile showed more week to week variation. Plants had similar vigour and runner production to 'Everest'.

EMR349. Everbearer. The highest yielding selection in the 2005 trial, exceeding the yield of 'Everest' every week throughout the season except one (week 28). Berries were glossy with uniform shape and flavour scores were similar to 'Everest'. Shelf-life was similar to 'Everest', although Brix readings were slightly inferior. Healthy looking plants with similar vigour to 'Everest', but with more prolific runner production.

4.4. Selections to be planted in grower trials in 2008

EM1282. Mid-season. Similar season to 'Elsanta' with slightly lower yield but better fruit size and better percentage class 1. Formerly trialled in 2003 (misted tip) and 2004 (60-day). Performance was better in the 60-day trial, so the selection was recycled. Berries are firm and glossy with good colour. Shelf-life similar to 'Elsanta' but average Brix slightly lower. Plants have moderate vigour but very big leaves. Produces large-crowned daughter plants and had a similar yield to 'Elsanta' as a 60-day plant in 2004.

EM1470. Late season. Similar season to 'Florence'. Good yield but average fruit size a bit small, with more medium than large berries. Berries have a good colour but rather seedy appearance. Ripening was often uneven at harvest time but this was not noticed in shelf-life tests, where performance was similar to 'Elsanta'. Brix very variable (range 5.0 – 11.4). Plants are quite dense and a bit more vigorous than 'Elsanta'.

EM1480. Early season, picked around three days earlier than 'Elsanta'. Moderate yield, but produced 91% class 1. Average fruit size was slightly smaller than 'Elsanta'. Berries are firm with very uniform shape and good colour. Pleasant flavour although average Brix was slightly lower than 'Elsanta'. Very good shelf-life. This was the most popular new selection among samples tasted at the HDC Fruit Walk in June 2006.

EM1552. Early season, approximately one week earlier than ‘Elsanta’. Very good yield for an early season type but fruit size is slightly smaller than ‘Elsanta’. Berries are firm but have a tendency to show some bruising in shelf-life tests. Attractive orange-red colour and conical in shape but with a slightly seedy appearance. Flavour is slightly aromatic. Brix readings are very variable between harvests. Plants are more vigorous than ‘Elsanta’, very erect with well-displayed fruit.

EM1572. Mid-season selection, with very high yield and large fruit size. Berries are glossy with good colour but on some harvests were considered slightly soft. Shape was a bit irregular on first two harvests but was then regular conic. Showed some bruising in shelf-life tests but overall was rated slightly better than ‘Elsanta’. Moderate flavour with Brix lower than ‘Elsanta’. Plants are tall and vigorous and would require wider spacing than ‘Elsanta’

EM1580. Mid-season with 50% pick date four days later than ‘Elsanta’. This selection was noted for its exceptionally high yield at 2.3kg per plant, although plants were vigorous and would require wider spacing than ‘Elsanta’. Average size was larger than ‘Elsanta’ but not excessively large, with only 11% by weight at >45mm diameter. Berries were firm with conical shape and a pale orange/red colour. The berries resembled ‘Eros’ in appearance, they had a matt finish and had uneven colour during harvest but in shelf-life tests the colour and overall appearance was rated superior to ‘Elsanta’. The flavour was mildly aromatic, with Brix similar to ‘Elsanta’. The plants had few runners and may have a tendency to produce branch crowns rather than runners, which would partly account for the very high yield.

EM1589. Not high yield but good fruit size and 91% class 1. Berries are firm, glossy and attractive with regular shape and good colour. Pleasant flavour – it has a slight ‘bubblegum’ aroma but not the aromatic flavour. Variable results in shelf-life tests and Brix similar to ‘Elsanta’. Plants are quite vigorous but the fruit is very well displayed.

EM1592. Late season, Same as ‘Florence’ with good yield but average fruit size is a bit small. Firm berries with good colour and uniform shape but slightly seedy appearance. Good shelf-life and Brix similar to ‘Elsanta’ but only moderate flavour. Plants have moderate vigour but are quite dense.

EM1597. Late season, similar to ‘Symphony’. High yield of very large berries. Glossy with good shape and colour but rather soft and bruises easily. Weak flavour. Tall plants but with good habit.

EM1599. Late season, similar to ‘Symphony’. Very good yield and fruit size. Firm berries with good colour but very large calyx, which detracted from the appearance. This large calyx would probably not be acceptable to supermarkets, although it is not uncommon on fruit imported from Spain and USA. Berries have a pleasant flavour and good shelf-life but Brix was very variable (range 5.3– 10.2). Plants are quite dense but have very erect habit.

EM1607. Mid-season, similar season to ‘Elsanta’. This was a very large fruited selection with lower yield than ‘Elsanta’ but 96% class 1. Berries were consistently very attractive and regular in shape, even on the largest primary berries. Colour and firmness were good, with shelf-life similar to ‘Elsanta’. Brix levels were similar to ‘Elsanta’, but flavour was mediocre. This selection is a daughter of ‘Florence’ but the plants were less dense and the fruit display was better, leading to rapid rate of harvest. Most of the trusses only had five flowers, which resulted in large berries and 26% by weight were >45mm diameter. However, in the 2006 trial there was considerable blossom weevil damage on this selection and without this the yield would probably have been higher and average size slightly smaller.

EM1624. Mid-season. Only moderate yield but good fruit size and 90% class 1**.** Attractive, glossy berries with very regular shape and good colour. Firmness was variable and was considered soft on two harvests. Pleasant aromatic flavour with ‘bubblegum’ aroma. High Brix but variable performance in shelf-life tests. Plant vigour was quite variable within the plot.

EM1628. Early season, picking around three days earlier than ‘Elsanta’ with a good yield producing 93% class 1 and fruit size similar to ‘Elsanta’. Attractive, glossy berries with good colour and regular shape, apart from the first harvest. Usually firm in texture but skin was slightly fragile on two occasions when picked in high temperatures. Pleasant, sweet flavour with Brix and shelf-life similar to ‘Elsanta’. Plants were slightly more vigorous than ‘Elsanta’, with an erect habit and good fruit display.

EM1636. Late season selection, comparable to ‘Florence’, with good yield and fruit size and 93% class 1. Berries had good colour and regular shape but slightly seedy appearance. Skin strength was good but the flesh was softer so the berries tended to bruise. Although mean Brix levels were recorded at 9.2, flavour scores were variable and on two occasions it was rated too acidic. Very erect plants with moderate vigour.

EMR370. Everbearer. Exceptionally high yielding, exceeding the yield of 'Everest' every week throughout the season (2006) except two (weeks 27 and 28). Well-displayed, light-coloured berries, sometimes with uneven ripening (reminiscent of 'Diamante', a parent of this selection). Flavour scores were similar to 'Diamante' but with higher Brix readings. Berries retained their brightness and fresh calyx during shelf-life tests, giving a better overall score than 'Everest'. Plants had similar vigour to 'Everest', but with a more open habit. Moderate runner production.

EMR376. Everbearer. Higher yield than 'Everest' but with similar fruit size. Berries were glossy with consistently good shape and colour. A fresher calyx than 'Everest' in shelf-life tests and gave a slightly better overall score than 'Everest'. Plants had similar vigour to 'Everest', but with more prolific runner production.

EMR386. Everbearer. Similar yield to 'Everest' but with smaller fruit size. However berries were well-displayed and had good colour, shape and a pleasant, sometimes sweet flavour. Texture was occasionally judged to be dry. Similar shelf-life score to 'Everest' but higher Brix readings. Slightly more vigorous than 'Everest' with more prolific runner production.

CONCLUSIONS

These trials, which are jointly funded by HDC and Meiosis Ltd, are a key stage in the evaluation of seedlings produced in the East Malling Research breeding programme. During the course of the project, 273 new selections were evaluated, of which 36 are currently undergoing further trialling on growers' farms. Four cultivars have been released during the project, with a further five scheduled to be released in 2007/08:

'Delia' was launched in 2005 because in grower trials it proved popular with a number of northern based growers with supermarket outlets.

'Judibell' has an established niche as a very late season cultivar for PYO and direct sales.

'Malling Pearl' has been widely planted in 2005 and 2006 and, despite problems encountered with crown rot in 2005; it is listed as a preferred cultivar by major multiples.

'Malling Opal' looks to have potential as an everbearer cultivar for PYO and direct sales.

TECHNOLOGY TRANSFER

A fruit walk and sampling session was arranged for levy payers during June of each year of the trial. Those attending were able to view the trial plots, talk to the strawberry breeding team and also taste fruit from the promising selections and standard cultivars. Tasters were invited to complete a simple form where they could rate the quality of the samples for flavour, appearance, colour and firmness. These data were then used to assist in decisions on which selections should progress to further trialling.

Factsheets summarising the trial results were produced in 2004, 2005 and 2006.

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Delia
An early June-bearing variety

Parentage

'Delia' (EM0835) was selected in 1995 from a cross between 'Honeoye' and an Italian breeding line.

Fruit Quality

The berries are very attractive with a bright orange red colour and glossy skin finish. The shape is very regular conical and eating quality is similar to Honeoye, juicy but slightly acidic. Shelf-life is very good, due to the bright colour and good firmness

Yield and Fruit Size

'Delia' was trialled at East Malling in 1997-98, 1999-2000 and 2004. In the first trial fruit quality was excellent but yield was low, due to poor establishment. In the two subsequent trials yield and fruit size has been slightly better than 'Elsanta' and percentage class 1 fruit has been >90% in all trials, which is superior to 'Elsanta'. Delia maintains large fruit size well on two-year-old plants, when average berry size is significantly larger than 'Elsanta'. This characteristic, combined with low percentage waste, results in rapid and economical harvesting.

Season

The season of 'Delia' is approximately seven days earlier than 'Elsanta' for 50% harvest.

Plant Characteristics

Plants have moderate vigour with upright habit and the fruit is well displayed. In trials 'Delia' has performed better when established from a misted tip rather than as a 60-day plant. Runner production is good.

Disease resistance

Delia does not have strong resistance to any of the common strawberry diseases and a spray programme equivalent to that used for 'Elsanta' is recommended. Soil sterilisation is necessary where there is a risk from wilt (*Verticillium dahliae*).

Use of the variety

Delia offers growers the opportunity to start the season with a productive variety that has a very attractive appearance, excellent shelf-life and crops one week earlier than 'Elsanta'. To take advantage of the early season, Delia should be protected from spring frosts, as flowering is also early.

Judibell
A very late June-bearing variety

Parentage

'Judibell' (EM0965) selected in 1996. It has a complex pedigree, which includes 'Pandora' and 'Elsanta' as grandparents.

Fruit Quality

Berries are attractive with a uniform shape and orange-red skin colour. Skin and flesh are medium firm, and the berries are juicy with a pleasant flavour and higher Brix than 'Elsanta' (average 8.5).

Yield and Fruit Size

Plants produce a moderate yield and fruit size is similar to 'Elsanta'.

Season

'Judibell' has an exceptionally late season with 50% harvest typically 35 days later than 'Elsanta'. This late cropping is the result of Judibell having an extended period of dormancy. In most seasons the plants remain dormant until mid May in southern England

Plant Characteristics

The plants have intermediate vigour and are quite dense. The fruit is partially hidden by the foliage. Runner production is late to commence and thus less prolific than most other June-bearer varieties.

Disease resistance

In tests at East Malling plants have shown good resistance to wilt (*Verticillium dahliae*) and crown rot (*Phytophthora cactorum*) combined with partial resistance to powdery mildew (*Podospaera aphanis*) and black spot (*Colletotrichum acutatum*).

Use of the variety

The exceptionally late season of 'Judibell' gives it a unique slot in the cropping calendar, being later than 'Sophie' and 'Pandora'. The variety has good all-round disease resistance and should perform well in traditional, low-input growing systems. In southern England most production will typically be in the second half of July and 'Judibell' thus offers growers a convenient opportunity for extending their season after 'Florence'. This will be particularly useful for growers in the pick-your-own and direct sales sector.

Malling Opal
A large-fruited everbearing variety

Parentage

'Malling Opal' (EMR287) was selected in 2001. The complex pedigree includes the varieties 'Evita', 'Selva', 'Elsanta', 'Providence' and 'Etna'.

Fruit Quality

The berries are moderately firm with a conical shape, mid-red colour and slightly raised seeds. Mostly the fruit is attractive but the primary berries are very large at the start of the season, and are often ribbed and seedy. 'Malling Opal' is distinguished by having excellent eating quality, with a juicy texture and sweet flavour. Brix levels have been consistently higher than 'Everest' in trials at East Malling. Shelf-life is good but 'Malling Opal' requires careful handling during periods of hot weather in order to avoid bruising.

Yield and Fruit Size

The yield of 'Malling Opal' has been higher than 'Everest' in trials at East Malling, and the average fruit size was larger, with a much greater proportion in the large (>35mm) size category.

Season

From a spring planting, harvesting begins in July and continues until October. In trials at East Malling 60% of the production has been in July/August and 40% in September/October, a similar pattern to 'Everest'.

Plant Characteristics

Plants have similar vigour to 'Everest', but runner production is greater and it is important to remove the runners regularly to maximise yield.

Disease resistance

Evidence from grower trials has indicated that 'Malling Opal' is susceptible to crown rot (*Phytophthora cactorum*). Growers are advised to use only bare-root plants and take appropriate precautions against the disease. A leaflet giving recommendations is available from propagators or Meiosis Ltd. 'Malling Opal' is moderately resistant to powdery mildew (*Podospaera aphanis*) and is susceptible to wilt (*Verticillium dahliae*).

Use of the variety

'Malling Opal' is a large fruited everbearing variety with excellent eating quality and will crop heavily over a long season. The variety is not suitable for supermarket outlets, the fruit not being firm enough and with very large, irregular primary berries in the early part of the season. However, Malling Opal does produce higher yields and larger fruit compared to 'Malling Pearl', and is very suitable for PYO, direct sales and the amateur market.

Malling Pearl
A large-fruited everbearing variety

Parentage

'Malling Pearl' (EMR286) was selected in 2001. The complex pedigree includes the varieties 'Evita', 'Selv'a, 'Elsanta', 'Providence' and 'Etna'.

Fruit Quality

The berries have a conical shape and attractive appearance with mid-red colour and slightly raised seeds. The berries are firm with a uniform shape. 'Malling Pearl' is distinguished by having excellent eating quality, with a juicy texture and sweet, well- balanced flavour. Brix levels have been consistently higher than 'Everest' in trials at East Malling. Shelf-life is excellent.

Yield and Fruit Size

The yield of 'Malling Pearl' has been higher than 'Everest' in trials at East Malling, and the average fruit size was larger, with a much greater proportion in the large (>35mm) size category. The percentage waste is low.

Season

From a spring planting, harvesting begins in July and continues until October. In trials at East Malling 60% of the production has been in July/August and 40% in September/October, a similar pattern to 'Everest'. To maximise the yield polythene tunnels are essential in the latter part of the season.

Plant Characteristics

Plants have similar vigour to 'Everest', but runner production is greater and it is important to remove the runners regularly to maximise yield.

Disease resistance

Evidence from grower trials has indicated that 'Malling Pearl' is susceptible to crown rot (*Phytophthora cactorum*). Growers are advised to use only bare-root plants and take appropriate precautions against the disease. A leaflet giving recommendations is available from propagators or Meiosis Ltd. 'Malling Pearl' is moderately resistant to powdery mildew (*Podospaera aphanis*) and is susceptible to wilt (*Verticillium dahliae*).

Use of the variety

'Malling Pearl' is a large fruited everbearing variety with excellent eating quality and will crop heavily over a long season. It is suited to all market outlets and sampling to supermarkets has already confirmed its appeal to this sector. It offers supermarket growers a real alternative to 'Everest', with better colour, larger fruit size, higher sugars and superior eating quality.