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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

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.

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GROWER SUMMARY

Headline

Eight new selections, six June-bearers and two everbearers, were selected in the 2013 EMSBC trials to progress to growers' trials. Of the six June-bearers, one was a very-early selection, one was early and the remainder were mid-season types. All will be trialled on growers' sites in 2015/16.

Background

The new contract for the East Malling Strawberry Breeding Club (EMSBC) was signed in June 2013 to follow on from the first tranche of the EMSBC breeding programme which had started in 2008. HDC continues to contribute to the EMSBC via project SF 96a. The main objective of the EMSBC strawberry breeding programme is to develop improved strawberry varieties, both June- and everbearing with increased yield, larger fruit size, an extended season of production and greater resistance to fungal diseases. This report covers three trials (June-bearer main crop, 60-day and everbearer trials) of EMSBC material assessed in 2013 as part of the preliminary trials held at East Malling Research.

Results of variety trials

The results from each trial are shown in the following tables:

Table 1 (a). June-bearer selections. Maincrop yield and berry size

Selection	Class 1 yield (g/plant)	% Class 1	% large fruit (>35mm)	50% pick date
EM2290	851	92	76	4 Jul
EM2298	669	85	60	1 Jul
EM2299	666	85	74	24 Jun
EM2301	1218	85	83	4 Jul
EM2315	812	85	55	1 Jul
EM2320	885	87	58	4 Jul
<i>Elsanta</i> ¹	637	57	49	6 Jul

¹Mean of two plots

Table 1(b). June-bearer selections. Maincrop fruit quality

Selection	Appearance (1-9)	Skin firmness (1-9)	Flesh firmness (1-9)	Flavour (1-9)	Shelf life (1-9)	Mean Brix
EM2290	6.0	6.6	6.5	5.9	4.7	8.2
EM2298	5.8	5.5	5.6	5.9	4.0	9.9
EM2299	5.9	6.4	6.1	5.4	3.0	7.1
EM2301	6.0	6.3	6.3	5.0	6.0	8.2
EM2315	5.7	6.1	6.2	6.0	3.5	8.5
EM2320	5.9	6.4	6.3	5.6	4.0	8.5
<i>Elsanta</i> ¹	4.9	5.9	5.4	5.1	3.5	8.2

¹Mean of two plots

Full descriptions of the fruit quality scoring system can be found in Appendix I of the main report, but as a guide 1=poor, 9=excellent

Table 2. June-bearer selections. 60-day yield and berry size

Selection	Marketable yield ¹ (g/plant)	% marketable yield	Mean crown diameter (mm)	Marketable (g/plant) yield per mm crown diameter	50% pick date
EM1977	187	86	8.1	23	15 Jul
EM2131	126	75	9.3	14	15 Jul
EM2135	260	92	9.0	29	18 Jul
EM2156	164	80	8.6	19	18 Jul
EM2161	199	92	9.0	22	18 Jul
EM2170	156	82	9.2	17	15 Jul
<i>Elsanta</i> ³	225	75	11.0	21	15 Jul
<i>Sonata</i>	211	80	9.1	23	18 Jul
<i>Vibrant</i>	270	88	9.0	30	15 Jul

¹ >25 mm, ² mean of two plots

Full descriptions of the fruit quality scoring system can be found in Appendix I of the main report, but as a guide 1=poor, 9=excellent

Table 3(a). Everbearer selections. Yield and berry size

Selection	Class 1 yield (g/plant)	% Class 1	% large fruit (>35mm)	50% pick date
EMR612	1371	78	60	15 Aug
EMR639	1038	74	60	27 Aug
<i>Evie 2</i> ¹	1138	73	58	20 Aug
<i>Finesse</i> ¹	1249	75	44	19 Aug

¹Mean of two plots**Table 3(b).** Everbearer selections. Fruit quality

Selection	Appearance	Skin firmness (1-9)	Flesh firmness (1-9)	Flavour (1-9)	Shelf life (1-9)	Mean Brix
EMR612	5.6	6.2	6.1	5.1	3.4	7.8
EMR639	5.6	6.0	6.4	5.6	4.0	8.7
<i>Evie 2</i> ¹	5.6	5.6	5.9	5.2	2.9	6.8
<i>Finesse</i> ¹	5.4	5.8	6.1	5.3	3.2	7.1

¹Mean of two plots

Full descriptions of the fruit quality scoring system can be found in Appendix I of the main report, but as a guide 1=poor, 9=excellent

SCIENCE SECTION

Introduction

This report covers three trials (June-bearer maincrop, 60-day and everbearer) as part of the preliminary trials assessed at East Malling Research in 2013 on behalf of the East Malling Strawberry Breeding Club (EMSBC). The EMSBC was set up in 2008 to continue the national strawberry programme that has operated at EMR since 1983 with the HDC contributing via project SF 96. A second tranche of the EMSBC was agreed in 2013 for a 10-year term (with a break clause after five years) and commenced on 1 June 2013. The funding members of the EMSBC are currently Berry Gardens Growers, CPM Retail, East Malling Services, Horticultural Development Company, Mack Multiples and Meiosis. The HDC continues to contribute to the EMSBC via project SF 96a.

It is the intention of the breeding programme to release new varieties which show 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 diseases (to minimise pesticide applications and the reliance on soil fumigation), fruit size and display (to reduce picking costs) or any combination of these characters.

In addition the programme will benefit from associated research projects funded at EMR that feed into the breeding work, primarily those associated with the development of molecular markers linked with disease resistance.

Trial methods

All trials were performed on the Ditton Rough plot (sandy loam soil) at East Malling Research, New Road, East Malling, Kent ME19 6BJ. Each trial was planted as double rows at 0.6 m spacing into fumigated raised beds with polythene mulch and trickle irrigation. These beds were covered prior to flowering with polythene clad tunnels for rain protection and also with netting against bird damage.

Main crop (June-bearer) trial

The maincrop trial contained 94 new selections, six advanced, re-cycled or re-trialled selections and four standards ('Elsanta', 'Sonata', 'Vibrant' and 'Fenella'). It was established from misted tips planted on 28 August 2012.

60-day trial

The 60-day trial included nine advanced selections, along with two standard cultivars ('Elsanta' and 'Sonata'). The trial was established using bare-root, cold-stored runners planted on 15 May 2013.

Everbearer trial

The everbearer trial contained 33 new selections and five advanced selections, plus standards ('Evie 2' and 'Finesse'). It was established from potted plants derived from misted tips and planted on 20 March 2013. Plants were de-blossomed during the third week of May and harvesting began on 4 July and continued twice weekly until the end of September.

Results and Discussion

Main crop (June-bearer) trial

The planting was later than usual due to the wet weather in 2012 delaying the land preparation and soil fumigation. The plants were fleeced during autumn to aid establishment but the later planting did result in lower yields, on average, than previous EMR trials. Cool weather during spring resulted in a late start to the season but the sudden change to hot weather during July produced a concertina effect and most selections had a very condensed picking period. This made it difficult to compare the relative cropping seasons of the different selections.

The results from the most promising selections are summarised in Table 4. Data on quality, yield and plant characteristics were considered together to identify the most promising selections and the Club Board decided to progress six new selections for growers' trials in 2015/16. These selections were:

EM2290 (Mid-season)

This selection had a good Class 1 yield (851g per plant) with large berries (76% >35 mm) and high percentage Class 1 (92%). Skin and flesh firmness were shown to be firmer than 'Elsanta' and berries had better shelf life. The fruit received good scores for sensory flavour but Brix readings were variable. Berries were attractive and with good shape and colour. Plants were compact with good, open habit and would be well suited for tunnels. EM2290 had a similar season to 'Elsanta'.



Figure 1. EM2290

EM2298 (Early season)

EM2298 had a moderate yield (669g per plant) but with good fruit size and a high percentage of Class 1 fruit. Berries were attractive and glossy with good shape and colour. Firmness was rather variable and shelf life was only tested once. However good scores were given for sensory flavour and berries had high Brix (mean 9.9°) throughout the season. Plants were tall with large leaves but not dense and had prolific runner production. EM2298 had a season similar to 'Vibrant'.



Figure 2. EM2298

EM2299 (Very early season)

This selection had only moderate yield (666 grams per plant) but had very good fruit size (74% >35mm) and high percentage Class 1 (85%). Attractive glossy berries with a good colour were produced but fruit shape was sometimes slightly irregular. Fruit had good firmness but shelf life was only tested on one occasion. Sensory flavour scores were similar to 'Elsanta' but gave a relatively low Brix (mean 7.1°). Plants were more compact than 'Elsanta' with good, erect habit and well displayed fruit. EM2299 had a very early season, with a 50% harvest date one week before 'Vibrant', although this cropping pattern would need verification in a year with more typical spring weather.



Figure 3. EM2299

EM2301 (Mid-season)

EM2301 gave the second highest yield in the trial (1218 grams per plant) and with 83% large berries (>35mm) and 85% Class 1. Berries were firm and attractive with good shape and colour but sometimes had white necks. Shelf life scores were very good. Flavour was acceptable and Brix readings were similar to 'Elsanta'. Plants were tall with erect, open habit and prolific runner production. EM2301 had the same season as 'Elsanta'.



Figure 4. EM2301

EM2315 had a good yield (812 grams per plant) with high percentage Class 1 (85%) and fruit size similar to 'Elsanta' (55% >35mm). Berries were attractive with good colour but shape was slightly irregular on the first two harvests. Skin and flesh firmness were good. Fruit had consistently good sensory flavour and Brix similar to 'Elsanta'. Plant vigour was slightly uneven but the leaf canopy was quite dense and not all fruit was well displayed. EM2315 had a season a few days earlier than 'Elsanta'.



Figure 5. EM2315

EM2320 (Mid-season)

A good yield (885 grams per plant) with high percentage Class 1 fruit (87%) was produced, and with fruit size similar to 'Elsanta' (58% >35mm). Berries had a reflexed calyx, with good colour and mostly uniform shape but with some irregular primaries. Skin and flesh firmness scores were good but shelf life tests were variable. Sensory flavour scores were variable as were Brix readings. Plants had moderate vigour but with big leaves and fruit was well displayed. EM2320 had a similar season to 'Elsanta'.



Figure 6. EM2320

60-day trial

The 60-day trial included six advanced selections that had been recommended for growers' trials by the Club Board in 2012, as well as three standards: 'Elsanta', 'Sonata' and 'Vibrant'. The trial was established using bare root cold stored runners planted on 15 May 2013. Crown diameters of all plants were measured prior to planting. The trial established well and the yields produced from the standards were as expected. Harvesting commenced on 11 July and fruit was picked and recorded twice weekly until 5 August, in what proved to be a very condensed season. The results of this trial are shown in Table 5.

EM2135 gave the highest yield (260g per plant) with a high percentage of marketable fruit (92%) and appears to be well adapted to the 60-day production system. EM2131, EM2156 and EM2170 all had a high mark-out, due mainly to slug damage, resulting in relatively lower Class 1 yields. The Club Board agreed that all the selections should continue for assessment in growers' trials in 2014/15.

Everbearer trial

The everbearer trial contained 28 new selections, four advanced selections and standards Evie 2 and Finesse. The trial was established from potted plants derived from pinned down tips, taken in August 2012, and planted on 20 March 2013. Plants were de-blossomed during the third week of May. Harvesting began on 4 July and continued twice weekly until 30 September. The trial plants established well after planting but were slow to develop in the colder than average temperatures that were experienced in April and May. Conditions improved in July and August with temperatures reaching over >25°C for prolonged periods, which may have led to thermodormancy in some selections. There was also some evidence of plant collapse within the plot, indicating that the fumigation of the soil may not have been totally effective, and this may have subsequently led to lower yields with some selections. The % Class 1 fruit for the standards was lower than might be expected in an average year, and appears to have resulted from a combination of both smaller fruit size than normal and slightly higher mark out. The waste could not be attributed to a single cause, with misshapes, some slug damage and powdery mildew all being cited as waste categories at different times during the season.

The results from the most promising selections are summarised in Table 6 and the Club Board decided to progress two new selections to growers' trials in 2015:

EMR612

The highest yielding selection tested in the trial (1371g per plant). Fruit size (60% >35mm) was similar to 'Evie 2', but better than 'Finesse'. The berries were glossy with a regular shape, had good firmness, but with sunken seeds. Flavour was acceptable with moderate Brix, and shelf-life was comparable to the standard (Finesse). The plants had similar vigour to 'Finesse' but slightly more upright habit, and appeared disease-free in the trial plot.



Figure 7. EMR612

EMR639

This selection had a moderate yield (1038g per plant) with good fruit size (60% >35mm). Fruit was glossy, attractive, firm and performed better than the standard (Finesse) in shelf life tests. Flavour was described as pleasant with good Brix scores (mean 8.7°). Plants were quite dense with more vigour than 'Finesse' but were healthy with no symptoms of mildew.



Figure 8. EMR639

Table 4. Main crop (June-bearer) results

Selection	Class 1 yield (g/plant)	% Class 1	% large fruit (>35mm)	Appearance	Skin firm	Flesh firm	Flavour	Shelf life score (1-9)	Mean Brix (min-max)	50% pick date	Vigour (1-9)	Density (1-5)	Display (1-3)
EM2290	851	92	76	6.0	6.6	6.5	5.9	4.7	8.2 (6.5-13.8)	4 Jul	5	3	3
EM2298	669	85	60	5.8	5.5	5.6	5.9	4.0	9.9 (7.5-12.7)	1 Jul	7	3	3
EM2299	666	85	74	5.9	6.4	6.1	5.4	3.0	7.1 (4.2-8.4)	24 Jun	5	3	3
EM2301	1218	85	83	6.0	6.3	6.3	5.0	6.0	8.2 (6.7-10.0)	4 Jul	6	3	3
EM2315	812	85	55	5.7	6.1	6.2	6.0	3.5	8.5 (6.4-13.0)	1 Jul	6	3	3
EM2320	885	87	58	5.9	6.4	6.3	5.6	4.0	8.5 (6.4-10.6)	4 Jul	6	3	3
<i>Elsanta</i> ¹	637	57	49	4.9	5.9	5.4	5.1	3.5	8.2 (6.0-11.6)	6 Jul	6	3	3

¹Mean of two plots

The key to fruit and plant characteristics scores are shown in Appendix I

Table 5. 60-day trial results

Selection	Marketable yield¹ (g/plant)	Unmarketable² yield (g/plant)	% marketable yield	Mean crown diameter (mm)	Marketable (g/plant) yield per mm crown diameter	50% pick date	Mean Brix (min-max)
EM1977	187	31	86	8.1	23	15 Jul	Not recorded
EM2131	126	42	75	9.3	14	15 Jul	10.2 (7.4-12.8)
EM2135	260	23	92	9.0	29	18 Jul	8.4 (5.5-12.9)
EM2156	164	40	80	8.6	19	18 Jul	10.1 (7.8-17.0)
EM2161	199	17	92	9.0	22	18 Jul	9.5 (8.0-11.6)
EM2170	156	34	82	9.2	17	15 Jul	10.0 (7.5-11.8)
<i>Elsanta</i> ³	225	75	75	11.0	21	15 Jul	9.0 (6.5-15.1)
<i>Sonata</i>	211	52	80	9.1	23	18 Jul	9.5 (5.8-13.6)
<i>Vibrant</i>	270	36	88	9.0	30	15 Jul	8.7 (5.5-13.4)

¹ >25 mm, ² < 25mm & waste, ³ mean of two plots

The key to fruit and plant characteristics scores are shown in Appendix I

Table 6. Everbearer trial results

Selection	Class 1 yield (g/plant)	% Class 1	% large fruit (>35mm)	Appearance	Skin firm	Flesh firm	Flavour	Shelf life score (1-9)	Mean Brix (min-max)	50% pick date	Vigour (1-9)	Density (1-5)	Display (1-3)
EMR612	1371	78	60	5.6	6.2	6.1	5.1	3.4	7.8 (6.1-10.9)	15 Aug	4	2	3
EMR639	1038	74	60	5.6	6.0	6.4	5.6	4.0	8.7 (5.9-10.6)	27 Aug	7	4	2
<i>Evie 2</i> ¹	1138	73	58	5.6	5.6	5.9	5.2	2.9	6.8 (4.7-8.6)	20 Aug	7	4	3
<i>Finesse</i> ¹	1249	75	44	5.4	5.8	6.1	5.3	3.2	7.1 (4.3-9.4)	19 Aug	4	3	3

¹Mean of two plots

The key to fruit and plant characteristics scores are shown in Appendix I

Conclusions

Main crop (June-bearer) trial

- Six new selections, EM2290, EM2298, EM2299, EM2301, EM2315 and EM2320 were identified as having potential and will now progress to growers' trials in 2015 (60-day) and 2016 (main crop).

60-day trial

- EM2135 showed the most promise in the 60-day trial, producing a high yield from a relatively small plant.
- All the remaining selections will continue to growers' trials for assessment as 60-day plants in 2014 and main crop in 2015.

Everbearer trial

- Two new selections, EMR612 and EMR639 were identified as having potential and will now progress to growers' trials in 2015.

Knowledge and Technology Transfer

A joint HDC/EMRA fruit walk was held on the evening of 27 June 2013 which allowed HDC members to sample both some new and advanced June-bearer selections from the EMSBC programme. Members were also given the opportunity to discuss the programme with Adam Whitehouse (Project manager) and Abi Johnson (Trials manager). This walk was well-attended with excellent feedback received from attendees.

An update on the EMSBC was presented by Abi Johnson at the HDC/EMRA Soft Fruit Day on the 21 November 2013.

Appendices

Scoring system employed for fruit and plant characteristics

Fruit characteristics:

Appearance

3=poor

5=acceptable

7=attractive

Skin Firmness

3=weak

5=acceptable

7=tough

Flesh Firmness

3=soft

5=acceptable

7=firm

Flavour

1=unpleasant

3=poor

5=acceptable

7=pleasant

9=very pleasant

Shelf life:

Overall Score

1=Very unattractive

3=Unattractive

5=Shape or colour may be uneven, there may be a few bruises

7=Even shape and colour

9=Attractive, looks fresh

Plant characteristics:

Plant Vigour
1=weak
5=intermediate
9=excessive

Plant Density
1=open
3=intermediate
5=dense

Fruit Display
1=poor
2=intermediate
3=good