Project title:	East Malling Strawberry Breeding Club
Project number:	SF 96a
Project leader:	Adam Whitehouse, NIAB EMR
Report:	Annual report, June 2020
Previous report:	SF 96a Annual Report 2019
Key staff:	Adam Whitehouse Abigail Johnson Katie Hopson Andy Passey
Location of project:	NIAB EMR
Industry Representative:	Louise Sutherland
Date project commenced:	1 June 2013
Date project completed (or expected completion date):	31 May 2023

AHDB, operating through its HDC division seeks to ensure that the information contained within this document is accurate at the time of printing. No warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

Copyright, Agriculture and Horticulture Development Board 2021. All rights reserved.

No part of this publication may be reproduced in any material form (including by photocopy or storage in any medium by electronic means) or any copy or adaptation stored, published or distributed (by physical, electronic or other means) without the prior permission in writing of the Agriculture and Horticulture Development Board, other than by reproduction in an unmodified form for the sole purpose of use as an information resource when the Agriculture and Horticulture Development Board or HDC is clearly acknowledged as the source, or in accordance with the provisions of the Copyright, Designs and Patents Act 1988. All rights reserved.

AHDB (logo) is a registered trademark of the Agriculture and Horticulture Development Board.

HDC is a registered trademark of the Agriculture and Horticulture Development Board, for use by its HDC division.

All other trademarks, logos and brand names contained in this publication are the trademarks of their respective holders. No rights are granted without the prior written permission of the relevant owners.

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.

Adam Whitehouse	
Programme Leader	
NIAB EMR	
Signature D	ate 31 st May 2020
[Name]	
[Position]	
[Organisation]	
Signature	Date
Report authorised by:	
Signature	Date
[Name]	
[Position]	
[Organisation]	
Signature	Date

CONTENTS

GROWER SUMMARY

Headline	5
Background	5
Results of selection trials	5
SCIENCE SECTION	
Introduction	12
Trial methods	12
Populte and Discussion	16

	10
Conclusions	36
Knowledge and Technology Transfer	37
Appendices	31

GROWER SUMMARY

Headline

Seven new selections; five June-bearers and two everbearers were selected from the 2019 East Malling Strawberry Breeding (EMSBC) preliminary trials to go forward to UK growers' trials. Of the five June-bearers there was one early-mid, one mid, two mid-late and one very-late season types. All will be trialled on UK grower sites in 2021/2022. In addition, ten advanced selections were trialled on growers' sites in 2019, with two progressing to further trialling (EM2622 and EMR704).

Background

The main objective of the East Malling Strawberry Breeding Club (EMSBC) is to develop and improved strawberry varieties, both June and everbearing with increased yield, larger fruit size, extended season of production and greater resistance to fungal diseases. Funding for the programme was renewed in 2013 to follow on from the first tranche of the EMSBC breeding programme which started in 2008 and that delivered the June-bearer variety Malling[™] Centenary. AHDB continues to contribute to the EMSBC via project SF 96a. In 2017 it was agreed that AHDB would continue to remain a member of the EMSBC and continue funding the programme until May 2023.

This report covers two preliminary trials held at NIAB EMR in 2019 that are partfunded by the AHDB membership of the EMSBC (June-bearer main crop and everbearer trials), as well as a brief summary of more advanced selections that have been assessed on offsite EMSBC growers' sites.

Results of selection trials

Descriptions and results from the most promising selections in each of the 2019 preliminary trials are shown below, accompanied with tables of results for each trial:

June-bearer (main crop) NIAB EMR trial

Five selections from the 2019 EMSBC trials showed sufficient potential to progress to small-scale growers' trials in 2021/22. A description of each selection appears below, listed in order of season (earliest to latest), with accompanying data show in Tables 1 and 2:

EM2763, an early-mid season June-bearer. First pick date identical to Malling[™] Centenary, but with a 50% harvest date three days earlier. Sensory flavour was judged to be sweet and this was reflected in a high mean Brix^o score.

EM2770, a mid-season selection with very large fruit size and a high percentage Class 1 fruit. It had a good overall fruit quality with a well-balanced, sweet-acid flavour.

EM2583, a mid-late season June-bearer. Good Class 1 yield, with a high percentage of large berries. Performed well in shelf life assessments.

EM2797, a mid-late season June-bearer, 50% pick date three days later than Elsanta. Scored well for sensory flavour and Brix^o. Excellent plant habit for tunnel production, and good fruit display for easy harvesting.

EM2625, a very late season selection with a 50% pick date four days later than Malling[™] Allure. Plants were more vigorous than the standards, which may be more suitable for outdoor or soil production.

Selection	Trial	Class 1 yield % Class 1		% large fruit	50% pick date
		(g/plant)		(>35mm)	
EM2763	Coir	687	90	54	10 June
EWIZ705	Soil	666	88	60	6 June
EM2770	Coir	860	90	72	20 June
	Soil	619	89	89	17 June
EM2583	Coir	795	79	48	20 June
	Soil	1013	90	61	13 June
EM2707	Coir	727	73	24	20 June
	Soil	1145	86	58	20 June
EM2625	Coir	375	60	37	1 July
	Soil	763	82	58	24 June
M Centenanu ¹	Coir	663	78	51	13 June
W. Centenary	Soil	447	91	51	10 Jun

Table 1. June-bearer selections: yield, fruit size and season

¹Mean of two plots

Selection	Trial	Appearance	Skin	Flesh	Flavour	Shelf	Mean
		(1-9)	firmness	firmness	(1-9)	life	Brix⁰
			(1-9)	(1-9)		(1-5)	
	Coir	5.5	6.2	6.5	5.5	2.5	9.2
	Soil	5.8	6.2	6.3	5.8	-	-
-	Coir	5.8	6.6	6.4	5.6	3.8	8.3
EM2770	Soil	5.5	6.4	6.3	5.7	-	-
-	Coir	5.5	6.1	6.1	5.8	3.2	8.9
EIVI2000	Soil	5.9	5.9	6.0	5.7	-	-
-	Coir	5.6	5.7	6.4	6.0	3.1	9.4
	Soil	6.0	5.9	6.0	5.7	-	-
-	Coir	5.2	6.5	6.4	5.0	3.0	8.9
EM2625	Soil	5.0	5.6	6.0	5.4	-	-
-	Coir	6.1	6.2	6.1	5.7	-	8.5
м. Centenary'	Soil	6.2	6.3	6.4	5.7	-	9.0

Table 2. June-bearer selections: mean fruit quality scores

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, shelf life comparison 1=worse, 3=same,5 better than standard.

Everbearer NIAB EMR trial

Two new selections were progressed to small-scale growers' trials in 2021. Descriptions of these selections and associated trial data (Tables 3 & 4) are shown below:

EMR862: Moderate yielding selection with a similar Class 1 yield, similar to Murano, but with better fruit size and a high percentage of Class 1 fruit. Berries were very attractive, with a uniform shape and glossy appearance.

EMR863: A high-yielding selection with excellent fruit size and very high percentage of Class 1 fruit. Berries had a very uniform, glossy appearance.

Selection	Class 1 yield	% Class 1	% large fruit	50% pick	
	(g/plant)		(>35mm)	date	
EMR862 ¹	620	81	57	5 Aug	
EMR863 ¹	977	88	68	5 Aug	
M. Champion ¹	747	73	42	18 July	
Finesse ²	854	70	48	18 July	
Murano ¹	613	66	43	5 Aug	

 Table 3.
 Everbearer selections: yield, fruit size and season

¹Mean of two plots ²Mean of four plots

Selection	Appearance	Skin	Flesh	Flavour	Shelf life	Mean
	(1-9)	firmness	firmness	(1-9)	(1-5)	Brix⁰
		(1-9)	(1-9)			
EMR862	6.1	6	5.9	5.6	4.3	8.2
EMR863	6.1	6	5.8	5.4	3	7.8
M. Champion ¹	5.8	6.4	6.4	5.4	3.9	7.4
Finesse ²	4.9	5.4	5.5	5.2	3.2	7.1
Murano ¹	5.1	5.9	6.1	5.4	3.	7.6

¹Mean of two plots ²Mean of four 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, and for shelf life comparison: 1=worse, 3=same,5 better than standard

Offsite main crop (June-bearer) growers' trial

Two advanced selections (EM2464 and EM2494) that had been overwintered on growers' sites from the 60-day trials in 2018 were main-cropped in 2019.

EM2464 is an early--midseason selection, with a moderate yield and a high percentage of Class 1 fruit similar to Malling[™] Centenary. Fruit is attractive with a bright, very glossy appearance. EM2464 scored highly across trial sites for fruit quality, with good skin and flesh firmness scores, and Brix scores averaged a high 8.7° across all sites. Plants have moderate vigour, with an upright habit, which combined with fruit held on long trusses allows for easy and rapid harvesting. Initial disease screening assessments at NIAB EMR indicate that EM2464 has useful levels of disease resistance with moderate resistance to crown rot and powdery mildew. EM2464had already been fast-tracked in trial and will undergo commercialisation with more extensive trialling in 2020.

EM2494 did not progress beyond the growers' 60-day trials, as it showed some susceptibility to crown rot.

Offsite 60-day (June-bearer) growers' trial

One advanced selection, EM2622 performed sufficiently well in the 60-day growers' trials to be overwintered and trialled as main cropping 2020.

EM2622 is a late season selection, with a similar season to Florence (10-14 days later than Malling[™] Centenary), plants produced a high percentage of Class 1 fruit. Fruit is attractive, uniform conic, with good colour and flesh firmness. Across 60-day growers' trials, EM2622 scored highly for sensory flavour, and was judged to be sweet, with a high average Brix^o score of 9.1^o. Plants had quite a dense canopy but with an upright habit and with well-displayed fruit. Initial disease screening assessments at NIAB EMR has intermediate resistance to crown rot (*Phytphthora cactorum*)

Offsite everbearer growers' trial

Three advanced selections were trialled in small-scale growers' trials: EMR773, EMR794 and EMR797 with two advanced selection in large-scale trials: EMR693 and EMR704. Two selections were progressed: EMR794 to large-scale growers' trials in 2020, and additional trialling for EMR704 in 2021

EMR794 is high yielding selection that averaged 1.1 kg/plant in the large-scale trials. It had a high percentage of Class 1 fruit (87%). Berries were attractive, with a uniform skin colour and glossy appearance. Sensory flavour was judged to be sweet, with a mean Brix^o of 8.1^o. Fruit was well displayed on long trusses. Initial disease screening at NIAB EMR indicates that EMR794 is moderately resistant to crown rot with intermediate resistance intermediate to mildew.

EMR704, is an early-season everbearer that has shown a steady crop profile. Plants produced an average yield of 1.1 kg /plant, and are noted for its large fruit size (mean 23 g/berry). Skin and flesh were firm, sensory flavour scored well with a high mean Brix^o of 9.0^o. Initial disease screening at NIAB EMR suggests that EMR704 has resistance to crown rot and mildew and intermediate resistance to Verticillium wilt. This selection was of particular interest to growers in Scotland, due an early season of production.

SCIENCE SECTION

Introduction

This report covers two trials (June-bearer main crop and everbearer) as part of the 2019 preliminary trials assessed at NIAB EMR 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 AHDB 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. In 2017, the AHDB agreed to remain a member of the EMSBC and continue part funding the programme until 2023 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), fruit size and display (to reduce picking costs) and any combination of these characters.

In addition, the programme is benefiting from associated research projects funded at NIAB EMR that feed into the breeding work, primarily those associated with the development of a molecular genetics approach to disease resistance. The integration of basic science to benefit the programme has recently been demonstrated by the use of predictive scores for disease susceptibility based on genotyping of all selections and parental lines.

In 2019, trialling in both coir substrate and the soil was performed with June-bearer selections. This is a precursor to moving all trials to substrate in 2020. Everbearers were all trialled in substrate in 2019.

Trial methods

The trials in two systems for June-bearers:

 Fumigated soil, raised beds. Village Fields plot at NIAB EMR, New Road, East Malling, Kent ME19 6BJ. This trial was planted into fumigated raised beds as double rows at 0.55 spacing. Each raised bed was covered by black polythene mulch and fertigated at fruiting stage via trickle irrigation (12:6:36 NPK, 25 kg/ha per week from fruiting) and alleys were strawed. Substrate (coir), table-tops. Ditton Rough plot at NIAB EMR, New Road, East Malling, Kent ME19 6BJ. The trials were planted in coir bags (CocoGreen, Manchester, UK) at six plants per bag.

Everbearers were only trialled in substrate (coir) on table-tops.

All trials were covered prior to flowering with polythene-clad tunnels for rain protection and netting against bird damage. An industry standard spray programme was followed for each trial.

Fruit was harvested twice-weekly from each trial into individual trays that were assigned a unique alpha-numeric plot code (to avoid selection bias). Fruit was graded into five categories, primarily based on fruit size (diameter in mm): giant (>45 mm), large (>35 mm), medium (>28 mm), small (<28 mm) and waste (fruit rendered unmarketable due to damage (physical and/or pathological), misshape or rots. Class 1, or marketable fruit, was classified as fruit >28 mm diameter, with unmarketable being defined as <28 mm diameter and waste fruit. Yield is presented as the mean of all plants in each individual plot.

Fruit quality (appearance, skin and flesh firmness and flavour) assessments were performed immediately after each pick, using the scoring system shown in Appendix I. Assessments were carried out by a panel of experienced breeders.

Post-harvest records of Brix^o (soluble sugars) and shelf-life, were taken as often as possible throughout the season with a minimum of three records for each selection per season.

Brix^o was measured using a sample of two berries per selection per pick that were halved longitudinally with the juice from each half-fruit being assessed using a digital refractometer. The mean score for each selection across the season are presented in the results section.

Shelf-life tests were performed on ten unblemished fruit that were sampled once a week for each selection during its fruiting season. Samples were collected at the fruit evaluation stage immediately after picking and were transferred in open, 454 g punnets to a +2 °C cold-store for 24 h. After 24 h these samples were transferred to

a controlled environment cabinet and maintained at 17 °C at 70% RH for a further 72 h. An assessment of each sample was then performed via a comparative assessment against a standard cultivar using the scoring system shown in the Appendix 1. The mean scores for each selection across the season are presented in the results section.

Main crop (June-bearer) trial

The main crop trial contained 74 new selections, 20 advanced, re-cycled or re-trialled selections and ten industry/season standard cultivars that were planted on 6th August 2018. Plots consisted of a maximum of six plants per selection, with the exception of re-trialled/recycled selections or standards which were replicated as two six plants plots and Malling[™] Centenary which was replicated as three, six plant plots. Misted tips were struck on 18th June 2018 and planted into coir bags on the 6th August. The tips were overwintered on sand beds before moving to table tops 28th March 2019.

Everbearer trial

The everbearer trial contained 35 new selections and ten advanced, re-cycled or retrialled selections, plus standard cultivars including Malling[™] Champion, Finesse and Murano. The trial was established from potted plants derived from pinned down tips, taken in August 2018, and planted into six-hole coir bags (CocoGreen, Manchester, UK) on 18th April 2019. Plants were de-blossomed on 13th May and harvesting began on 26th June 2019 and continued twice weekly until 16th September 2019. Each selection was replicated twice (twelve plants per selection, six pants in two bags) with the exception of re-trialled/recycled selections or the standards which were replicated with up to a maximum of four times.

Offsite Growers trials

EMSBC offsite growers' trials are hosted and financed by individual EMSBC members on their own farms, so only a brief summary of trial methods for these trials are presented. Fourteen offsite growers' trials were used in total for 60-day, main crop and everbearer trials.

Offsite main crop (June-bearer) growers' trials

Two advanced selections: EM2464 and EM2494, were assessed for yield and fruit

quality in main crop trials in 2019. Both were assessed on three growers' sites, after first being assessed as 60-day plants (60 tray or waiting bed plants per site) in 2018, and originally selected for grower trials in 2016. The plants were in grown in substrate, with two trials under polythene-clad tunnels and one in glasshouse production.

Offsite 60-day (June-bearer) growers' trials

Six advanced selections were assessed for yield and fruit quality in small-scale 60day offsite trials in 2019: EM2248, EM2434, EM2541, EM2544, EM2588 and EM2622. All UK plantings were in substrate under polythene-clad tunnels. Selections were trialled in small-scale trials (60 tray plants per site) having been selected for growers' trials in 2017.

Offsite everbearer growers' trials

Five advanced everbearer selections were assessed for yield and fruit quality in offsite trials in 2019: three (EMR773, EMR794 and EMR797) in small-scale trials (60 tray or waiting bed plants per site) and two (EMR693 and EMR704) in large-scale trial (a maximum of 1000 tray or waiting beds per site). All UK plantings were in substrate under polythene-clad tunnels. EMR693 and EMR704 were assessed in large-scale trials after being selected for growers' trials in 2015, and the remaining selections in small-scale trials (60 tray plants per site) after selection for growers' trials in 2017.

Results and Discussion

Main crop (June-bearer) NIAB EMR trial

They established very well with good side crown development during the mild autumn. Conditions remained mild until the end of January 2019, where a severe frost resulted in the plants being covered with fleece for several days. Weather soon improved with higher than average spring temperatures which pushed on plant development. However, a cold snap in mid-May slowed production, which leads to a delayed cropping.

The trial data for the five selections chosen to progress to growers' trials in 2021/2022 are shown in Table 6, and a short description of each follows:

EM2763 (Early-mid season)

Substrate trial

An early-mid season selection, with a 50% pick date identical to Malling[™] Centenary (Figure 1.b.). Plants gave a moderate yield (687g/plant) with a high percentage of Class 1 fruit (90%). Berry size was comparable to the standard with 54%> 35 mm (Figure 1.d.). Fruit was attractive with good firmness and pale flesh. Firmness was very good, and flavour was variable but often judged to be sweet, with a high mean Brix° score (9.2°), but with a non-strawberry (pear-like) flavour. Plants had moderate vigour with distinctive 'puckered' leaves and with some chlorosis towards the end of the trial, mildew pressure was high, which resulted in some mildew being noted on the runners.

Soil trial

An early-mid season selection, with a 50% pick date 4 days ahead of Malling[™] Centenary and Elsanta (Figure 1.c.), but picked over a relatively short season. Moderate yield with high % Class 1 fruit and good fruit size, but some early fruit was lost to bird damage. Appearance is similar to Malling[™] Centenary but with a blunterconic shape. Firmness was very good, and flavour was described as pleasant with some sweetness, but also non-strawberry (pear-like) flavour. Plant had moderate vigour with distinctive 'puckered' leaves and some chlorosis. One plant was found to

have died post cropping



Figure 1.a. Fruit of EM2763



Figure 1.b. Cropping profile of EM2763 in substrate



Figure 1.c. Cropping profile of EM2763 in soil



Figure 1.d. Mean Class 1 yield per plant (g/plant) of EM2763 in substrate, compared to standards in substrate



Figure 1.e. Mean Class 1 yield per plant (g/plant) of EM2763 in soil, compared to standards in substrate

EM2770 (Midseason)

Substrate trial

A midseason selection, with a 50% pick date (17 June), ten days later than Malling[™] Centenary (Figure 2.b.). Moderately high yielding plant, producing an average of 860 g/plant. Fruit size was very large (72% >35 mm) with a high percentage of Class 1 fruit (90%) (Figure 2.d.). Berries were attractive, with a very glossy appearance, which combined with a strong skin and flesh firmness resulted in high, overall fruit quality scores. In sensory testing EM2770 was judged to have a good sugar:acid balance with an average Brix° 8.3°. Plants were quite vigorous with big leaves, but with an upright habit which allowed a good fruit display and improved picking conditions. Some mildew was noted on plants towards the end of the season. EM2770 performed well in shelf-life tests and was noted for retained its glossy appearance.



Figure 2.a. Fruit of EM2770



Figure 2.b. Cropping profile of EM2770 in substrate



Figure 2.c. Cropping profile of EM2770 in soil



Figure 2.d. Mean Class 1 yield per plant (g/plant) of EM2770 in substrate, compared to standards



Figure 2.e. Mean Class 1 yield per plant (g/plant) of EM2770 in soil, compared to standards

EM2583 (Mid-late season)

EM2583 was being re-trialled from the 2017 NIAB EMR trial, where it had a late season of production, that had an intermediate yield and with some variability in flavour scores.

Substrate trial

In substrate, EM2583 cropped as a mid-late season variety (Figure 3.b.), with a 50% pick date (20th June) falling between Malling[™] Centenary and Malling[™] Allure. Class 1 yield was moderate (795 g/plant), with fruit size similar to the standards (48% <35 mm) (Figure 3.d.). Berries were attractive with a glossy, bright skin which was retained in shelf life tests. Sensory flavour was considered pleasant with an average Brix° score of 8.9°. The calyx on the fruit was quite leafy, with white streak was recorded on fruit from one plant. Plants had intermediate vigour and appeared to be suited to tunnel production with long trusses and well displayed fruit for rapid

harvesting

Soil trial

Mid-late season with 50% pick date between Malling Centenary and Malling Allure (Figure 3.c.). Class 1 yield was relatively high for the trial, surpassing the late standards, with good fruit size and % Class 1 (Figure 3.e.). Fruit was glossy, with a bright appearance and despite some variable flavour scores at the start of the pick was judged to improve as the season progressed. Firmness was generally good, but skin firmness was marked down on picks during hot weather. Plants were suited to tunnel production, with intermediate vigour and excellent fruit display.



Figure 3.a. Fruit of EM2583



Figure 3.b. Cropping profile of EM2583 in substrate



Figure 3.c. Cropping profile of EM2583 in soil



Figure 3.d. Mean Class 1 yield per plant (g/plant) of EM2583 in substrate, compared to standards



Figure 3.e. Mean Class 1 yield per plant (g/plant) of EM2583 in soil, compared to standards

EM2797 (Mid-late)

Substrate trial

A moderately high-yielding selection that averaged 727 g/plant with an acceptable percentage of Class 1 fruit (73%) (Figure 4.d.). Fruit size differed considerably between the substrate and soil trial (24% cf. 58% >35 mm respectively). The 50% pick was three days later than Elsanta (Figure 4.b.). Berries were attractive but had a distinctive, 'spikey' calyx. EM2797 was liked by visitors, with a well-rounded flavour with good sweetness, balanced with background acidity. This was reflected in the high average Brix° score (9.4°). Plants appear to be well-suited for tunnel production, with an erect habit and fruit displayed well for rapid harvesting. The plants were also disease free.

Soil trial

EM2797 was the second highest yielding selection in the trial with a mid-late season of production, concentrated in a peak in mid-June (Figure 4.c.). The percentage of Class 1 fruit was high and fruit size was excellent (Figure 4.e.). Berries were glossy with a uniform shape, but skin colour was quite dark, and this was noted throughout the season. Skin firmness was all considered fragile towards the end of the season. Flavour was generally considered to be pleasant, but was weak and watery on some occasions. Plants were vigorous, with a dense leaf canopy and 3 of the 5 plants were showing symptoms of Verticillium wilt at the end of the season.



Figure 4.a. Fruit of EM2797



Figure 4.b. Cropping profile of EM2797 in substrate



Figure 4.c. Cropping profile of EM2797 in soil



Figure 4.d. Mean Class 1 yield per plant (g/plant) of EM2797 in substrate, compared to standards



Figure 4.e. Mean Class 1 yield per plant (g/plant) of EM2797 in soil, compared to standards

EM2625 (Very late)

Substrate trial

A very late selection that had a 50% pick date four days (1 July) later than Malling[™] Allure (Figure 5.b.). Class 1 yield was low (375 g/plant) as a result of high mark out due to misshapes, rots and splitting (Figure 5.d.). Fruit had a regular shape, but with raised seeds, was sometimes described as blotchy and slightly uneven shape. Sensory flavour was described as non-strawberry (melon-like), but with an average of Brix° 8.9°. EM2625 was originally trialled in 2017, and re-trialled as the plants were a bit too vigorous, however in substrate the plants had a very upright habit. Results in 2017 were more positive, with a yield of 709 g/plant, Class 1 of 79%, mean Brix° 9.8° and a 50% pick date between Florence and Malwina (Figure 5.c.). Further trialling was requested due to its lateness and possible suitability for the European market.

Soil trial

A very late season selection, with a peaky crop profile, and 50% pick date four days later than Malling Allure (Figure 5.c.). Class 1 yield was greater than the late season standards, but with a relatively high mark out due to rots (Figure 5.e.). Fruit had a regular shape, but raised seeds and white necks on some picks. Skin colour could be blotchy and variable within the punnet. Plants weren't as vigorous as in 2017, and fruit was well-displayed. Flavour was often described a non-strawberry like but pleasant (melon, lychee).



Figure 5.a. Fruit of EM2625



Figure 5.b. Mean Class 1 yield per plant (g/plant) of EM2583 compared to standards in substrate



Figure 5.c. Mean Class 1 yield per plant (g/plant) of EM2625 compared to standards in soil



Figure 5.d. Mean Class 1 yield per plant (g/plant) of EM2625 in substrate, compared to standards



Figure 5.e. Mean Class 1 yield per plant (g/plant) of EM2625 in soil, compared to standards

Everbearer NIAB EMR trial

The trial was planted into coir bags on 18th April 2019. Plants established well and were de-blossomed on 13th May 2019. Planting coincided with a slight dip in temperatures at the end of April through to mid-May. By the end of May conditions improved and were warmer than average which helped to push on progression of the plants. However, by June, the forecast had turned with very heavy rainfall, this delayed ripening of fruit with the first harvest occurring on the 27th June. The weather would continue to be unsettled throughout the season, July and August were hotter than average, but also wetter than what has been seen in previous years. It turned into a season of extremes, as a heat wave hit towards the end of July, which resulted in the UK recording its hottest day ever, East Malling weather station recorded 35 °C at its peak (typical temperature of 21 °C). During this period, some of the selections did suffer with uneven ripening, with skin fragility, which would be expected under such extremes. Conditions were also perfect mildew, which why it isn't surprising that the everbearers began to suffer with this towards the end of the season. Last pick took place on 16th September.

The results from the most promising selections for UK growers is summarised in Table 7. Data quality, yield and plant characteristics were considered together to identify the most promising selections trialled in 2019. The EMSBC Board decided to progress two selections to UK growers' trials in 2021, and the descriptions of these selections appears below:

EMR862

EM862 produced a steady crop of fruit throughout the season (Figure 6.b.). Class 1 production was similar to Murano at 620 g/plant, without a prominent peak in production and with larger fruit size (58% >35 mm) and higher overall percentage Class 1 fruit (79%)(Figure 6.c.). Fruit quality was excellent, as it was very attractive and glossy. Overall, sensory flavour was judged as good, sometimes sweet, but could be a little variable. Brix° scores were relatively high (for this season) in comparison to the standard (7.6°) with an average of 8.2°. Shelf-life scores were excellent as the fruit retained its gloss in storage. Plants had moderate vigour with very good fruit display. Berries were held on long trusses below the canopy for easy

picking. Plants in the trial were healthy but showed a slight susceptibility to mildew towards the very end of the season when it was recorded on the runners. EMR862 is yet to undergo any pathogen screening, however predictive scoring suggests that this selection may have moderate resistance to crown rot.



Figure 6.a. Fruit of EMR862



Figure 6.b. Cropping profile of EMR862



Figure 6.c. Mean Class 1 yield per plant (g/plant) of EMR862 compared to standards in substrate

EMR863

A very high yielding selection (964 g/plant) with excellent fruit size (67%>35 mm) and very high percentage Class 1 (88%) (Figure 7.c.). Fruit quality scored very highly. It stood out in the punnet and on the plant for its glossy, uniform conic appearance. Its scores dropped only temporarily during a particularly hot period of the season, where colouration suffered slightly and became a little uneven. Sensory flavour was often described as sweet, but sometimes watery but overall EMR863 had a good average Brix° scores with a mean of 7.8° comparable, to Murano's average of 7.6° for this trial. Skin strength results throughout the season were strong with flesh firmness slightly softer. Fifty percent pick date came early in the season, however, production in week 30, which mirrored the standards (Figure 7.b.). For the majority of the season, the plants were clean and healthy, but towards the end of the season, mildew was noted on a few of the berries and runners. EMR863 is yet to undergo any pathogen screening; however, predictive scoring suggests that this selection may have intermediate to moderate resistance to crown rot.



Figure 7.a. Fruit of EMR863.



Figure 7.b. Cropping profile of EMR863



Figure 7.c. Mean Class 1 yield per plant (g/plant) of EMR863 compared to standards in substrate

Offsite main crop (June-bearer) growers' trials

Two selections were carried forward from offsite 60-day (June-bearer) growers' trials in 2018: EM2464 and EM2494. The EMSBC Board decided to discontinue trialling of EM2494 due to disease susceptibility. EM2464had already been fast-tracked in trial and will undergo commercialisation with more extensive trialling, including agronomic work in 2020.

Offsite 60-day (June-bearer) growers' trials

The results of the offsite growers' trials were reviewed by the EMSBC Board in October 2019 and it was agreed that one selection (EM2622) trialled in the small scale 60-day trials should continue to main crop offsite trials in 2020. Trialling of EM2248, EM2434, EM2541, EM2544 and EM2588 would discontinue as they had been superseded by newer selections in the pipeline that appear to have stronger pathogen resistance. A summary of EM2622 that is to be carried forward to main crop trials is shown below:

EM2622

A late season selection, with a Class 1 yield slightly higher than Malling[™] Centenary in comparative growers' trials (mean of 586 g/plant vs 507 g/plant respectively) and a high percentage of Class 1 fruit (mean 90%). Fruit was attractive, firm flesh, uniform conic with good colour. Sensory flavour was sweet with some acidity, high overall mean Brix° score of 9.1° from all trials. Plants were vigorous, with dense foliage, but with an upright habit with good fruit display. In initial pathogen screening assessments at NIAB EMR it was indicated that EM2622 has intermediate resistance to crown rot, and is moderately susceptible to powdery mildew and susceptible to Verticillium wilt.

Offsite everbearer growers' trials

The results of the offsite growers' trials were reviewed by the EMSBC Board in October 2019. Three selections were assessed in small scale offsite growers' trials, of which, it was decided that EMR794 would progress to large-scale trials in 2021 and EMR773 and EMR797 would be deselected.

Two selections were assessed in large scale trials, EMR693 and EMR704. EMR693, was deselected, with EMR704 to be re-evaluated in 2021.

EMR794 is a midseason everbearer, similar to Murano, with a good yield of Class 1 fruit (1.7kg per plant). Habit is fairly open with well displayed fruit on long trusses. Fruit is attractive, glossy, uniform conic with good colour. Average fruit size was

good with an average size across the sites of 20.5 g per berry. Fruit was thought to be sweet, with a good mean Brix^o of 8.1^o. Pathogen screening has shown that this variety has moderate resistance to crown rot, moderate susceptibility to wilt and intermediate resistance to mildew. This accession was a favourite on certain sites and thought to have good variety potential.

EMR704 is an early season everbearer, with good continuity of production throughout the season, and can be picked until November. Scottish growers particularly liked this selection as it cropped early in the season, and had its first flush of fruit in early June (2017). EMR704 had moderate yield with a mean of 951 g per plant across trial sites in 2019, with a good percentage of Class 1 (83 %). Plant habit was said to be upright, but with an open habit. Fruit had firm skin and flesh, appearance also scored well but had a slightly darker colour. Sensory flavour was a little variable, but with an average Brix° of 8.3° across sites. Pathogen screening suggests that this selection is resistant to crown rot, intermediate resistance to wilt and moderate resistance to mildew.

Selection	Trial	Class 1	%	% large fruit	Appearance	Skin	Flesh	Flavour	Shelf life	Mean Brix°	50% pick	Vigour	Density	Display
		(g/plant)	Class 1	(~551111)	(1-9)	(1-9)	(1-9)	(1-9)	(1-5)	(min-max)	uale	(1-9)	(1-5)	(1-3)
EM2762	Coir	687	90	54	5.5	6.2	6.5	5.5	2.5	9.2	10 June	6	4	3
EWZ703 =	Soil	666	88	60	5.8	6.2	6.3	5.8	-	-	6 June	-	-	-
EM2770	Coir	860	90	72	5.4	6.2	6.2	5.3	3.8	8.3	20 June	5	3	3
	Soil	619	89	89	5.5	6.4	6.3	5.7	-	-	17 Jun	-	-	
EM2583	Coir	795	79	48	5.5	5.6	5.7	5.6	3.2	8.9	20 June	6	3	3
LIVI2303 -	Soil	1013	90	61	5.9	5.9	6.0	5.7	-	-	13 June	-	-	-
EM2707	Coir	727	73	24	5.6	5.9	6.1	5.9	3.1	9.4	20 June	6	3	3
	Soil	1145	86	58	6.0	5.9	6.0	5.8	-	-	20 June	-	-	-
EM2625	Coir	375	60	37	5.2	6.1	6.1	5.0	3.0	8.9	1 July	5	3	3
	Soil	763	82	58	5.0	5.6	6.0	5.4	-	-	24 June	-	-	-
M Cent ²	Coir	718	78	51	6.1	6.2	6.1	5.7	-	9.0	13 June	-	-	-
	Soil	447	91	51	6.2	6.3	6.4	5.7			10 Jun			

Table 6. Main crop (June-bearer) results (standards in *italics*)

¹Mean of two plots ²Mean of two plots

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

Selection	Class 1 yield (g/plant)	% Class 1	% large fruit (>35mm)	Appearance (1-9)	Skin firm (1-9)	Flesh firm (1-9)	Flavour (1-9)	Shelf life score (1-5)	Mean Brix⁰ (min-max)	50% pick date	Vigour (1-9)	Density (1-5)	Display (1-3)
EMR862	620	81	57	6.1	6	5.9	5.6	4.3	8.2 (6.1-10.4)	5 Aug	5	3	3
EMR863	977	88	68	6.1	6	5.8	5.4	3	7.8 (6.1-9.3)	8 Aug	6	3	3
M. Champion ¹	747	73	42	5.8	6.4	6.4	5.4	3.9	7.4 (5.6-9.1)	18 Jul	2	4	3
Finesse ²	854	71	48	4.9	5.4	5.5	5.2	3.2	7.1 (6.0-8.7)	18 Jul	-	-	-
Murano ¹	613	66	43	5.1	5.9	6.1	5.4	3.	7.6 (5.8-9.6)	5 Aug	5	3	-

 Table 7. Everbearer trial results (standards in *italics*)

¹Mean of two plots ² Mean of four plots

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

Conclusions

Main crop (June-bearer) trial

 Five selections. EM2763, EM2770, EM2583, EM2797 and EM2625 were identified as being of sufficient interest to progress to growers' trials in 2021 (60-day) and 2022 (main crop). Two selections were of particular interest, EM2770 and EM2797. EM2770, was a good all-rounder that performed well for all parameters. EM2797 had a little variability with regard to yield, however, flavour profile scored highly, making it a favourite of assessors.

Everbearer trial

 Two new selections, EMR862 and EMR863 were identified as being of sufficient interest to progress to growers' trials in 2021. Both had excellent fruit quality. EMR863 had a very steady production with no peaks, with large fruit size and high yield.

Offsite main crop (June-bearer) trials

• Two advanced selections (EM2464 and EM2494) were trialled in 2019. EM2494 was deselected, and EM2464 will be progressing to larger-scale trials and commercialisation.

Offsite 60-day (June-bearer) trials

 One advanced selection: EM2622, was deemed to have performed sufficiently well to carry forward to main crop offsite trials. EM2622 is a late season selection with good fruit quality and high percentage of Class 1 fruit. Berries have a regular conic shape and attractive appearance, combined with sweet flavour that was rated highly in retailer sampling sessions. Plants are vigorous, but with an upright habit and excellent fruit display.

Offsite everbearer trials

• One advanced selection, EMR704, will progress to further trialling in 2021 with consideration given to commercialisation.

Knowledge and Technology Transfer

A joint AHDB/EMRA fruit walk was organised for the 6th June 2019 to allow AHDB levy payers to sample and discuss the latest selections from the EMSBC programme. In addition AHDB representatives (Katja Maurer, Louise Sutherland and Rachel McGauley) were able to attend Board meetings (February, August and October) where updates on the programme, trials and selections were made. *Ad hoc* sampling sessions were also carried out to AHDB representatives throughout the summer.

Appendices

Appendix I. 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:	
Comparison to standard	1=Much worse 2=Worse 3=Same 4=Better 5=Much better
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