Project Title:	Raspberry: commercial evaluation of new summer fruiting varieties and selections
Project number:	SF41b
Project leader:	Janet Allen, ADAS, Boxworth
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Key staff:	Janet Allen
Location of project:	Manor Farm, Forest Hill, Oxford, Oxon
Project coordinator:	Mr Peter Thomson
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Key words:	Raspberry, varieties, cultivars, Glen Moy, Glen Ample, Tulameen, Octavia, Malling Minerva, Malling Hestia, Malling Juno, Glen Doll, Glen Fyne, Cowichan, Kitsilano, Saanich, Esquimalt, Chemainus, Coho, Rubaca, Wei-Rula

The results and conclusions in this report are based on a series of experiments conducted over a five-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.

Mrs J Allen

Horticultural Consultant

ADAS

Signature ..... Date

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Report authorised by:

Dr W E Parker

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Signature ..... Date

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Grower Summary

Headline

- Malling Juno (early season), Glen Fyne (early/mid season), Glen Doll (mid/late season) and Cowichan (mid/late season) offer potential to complement or replace the summer fruiting raspberry varieties Glen Ample and Tulameen.

Background and expected deliverables

Since the late 1980s, the mid-season summer fruiting raspberry varieties Glen Ample and Tulameen have dominated the industry in the UK. More recently they have been joined by the late-summer fruiting variety Octavia. If planted in the open field, these three varieties currently spread the production season from late June/early July to early August.

Unfortunately both Glen Ample and Tulameen exhibit marked failings, particularly with regard to lack of resistance to pest and disease and occasional imperfect berry set, shape and post-harvest life. Primocane and floricane management can also be difficult and in the case of Glen Ample, the unexplainable loss of plant vigour within two or three years of planting.

This project assessed varieties and seedling selections from UK, Canadian, German and USA plant breeding programmes. They were planted on the same site to examine their potential under UK growing conditions. A range of desirable characteristics were assessed including:

- High yield production
- Reliable cropping
- Production of firm berries with a long post-harvest life
- Good flavour and appearance i.e. colour, shape, set and size
- Ease of picking, i.e. well displayed on the plant to pickers and readily detached from the receptacle
- Robustness and ease of plant management

- Resistance or tolerance to many of the major diseases and pests that affect the raspberry

Some of the UK selections entered in this trial had previously been assessed by the Scottish and East Malling Raspberry Breeding Consortia, to which HDC belongs.

This overall aim of the work is to identify new varieties that will potentially replace existing varieties that are destined for supermarket sales. Varieties suitable for sale via other market outlets including Pick Your Own will also be identified.

At the time of the planning and planting of this trial, the majority of the area devoted to raspberry production in the UK was in the open field. However, since 2003 there has been a steady increase in the proportion of the area of summer fruiting raspberries protected for at least part (and sometimes all) of each cropping season, often in temporary polythene clad structures. By 2006 the majority of the crops grown for supermarket sales were being provided with protection, so that the harvest period for the crop could be extended and the quality and volume of product required by the market maintained no matter what weather conditions prevail. Although this trial was planted in the open field, whenever applicable, data was collected to provide guidance on the potential suitability of entries for protected cropping (e.g. date of bud break and harvest, lateral length, strength of attachment, cane habit, pest and disease susceptibility etc).

Summary of the project and main conclusions

Trial design & conduct

The trial was set up on a single site at Manor Farm, Forest Hill, Oxford, courtesy of The Rt. Hon. Richard Stanley. The selections included in the trial and their respective planting dates are provided in Table 1. Care should be taken when interpreting the season of production for each variety listed. This has been based on the season of production recorded in this trial alone and not on any other trial results or commercial experience.

Table 1. Selections planted, source and seasonal position (type) and planting date of raspberries planted in the trial area

Selection	Included as	Propagation method	Type	Source	Planting date
Glen Moy (control)	Main entry	Rooted cutting	Early	SCRI	July 2002
EM 6390/47	Main entry	Rooted cutting	Early	EMR	July 2002/03
EM 6544/80 (Malling Juno)	Main entry	Rooted cutting	Early	EMR	July 2002
Glen Ample (control)	Main entry	Rooted cutting	Mid	SCRI	July 2002
Glen Ample (control)	Main entry	Micropropagated	Mid	SCRI	July 2002
EM 6545/12	Main entry		Mid	EMR	July 2002
9059D-2	Main entry	Micropropagated	Mid	SCRI	July 2002
9062-E1 (Glen Fyne)	Main entry	Micropropagated	Mid	SCRI	June 2004
9050RD3	Main entry	Micropropagated	Mid	SCRI	July 2002
9046RA2	Main entry	Micropropagated	Mid	SCRI	July 2002
Tulameen (control)	Main entry	Rooted cutting	Mid/Late	PARC	July 2002
Tulameen (control)	Main entry	Micropropagated	Mid/Late	SCRI	June 2003
EM 6428/1	Main entry	Rooted cutting	Mid/Late	EMR	July 2002
EM 6506/37	Main entry	Rooted cutting	Mid/Late	EMR	July 2002
9053B6 (Glen Doll)	Main entry	Micropropagated	Mid/Late	SCRI	July 2002
EM 6385/1	Main entry	Rooted cutting	Late	EMR	July 2002
EM 6512/50 (Octavia)	Main entry	Rooted cutting	Late	EMR	July 2002
EM 6413/59	Guard	Rooted cutting	Early	EMR	July 2002
BC 89-2-89 (Esquimalt)	Guard	Rooted cutting	Early	PARC	June 2003
EM 6166/89 (Malling Minerva)	Guard	Rooted cutting	Mid	EMR	July 2002
BC 89-33-84 (Chemainus)	Guard	Rooted cutting	Mid	PARC	July 2002
BC 90-8-20	Guard	Rooted cutting	Mid	PARC	June 2003
Rubaca	Guard	Rooted cutting	Mid	German	June 2003
Kitsilano	Guard	Rooted cutting	Mid	PARC	July 2002
BC 90-8-11	Guard	Rooted cutting	Mid	PARC	June 2003
EM 6507/35	Guard	Rooted cutting	Mid	EMR	July 2002
EM 6487/74	Guard	Rooted cutting	Mid	EMR	July 2002
9612F-2	Guard	Micropropagated	Mid	SCRI	June 2004
9751E-2	Guard	Micropropagated	Mid	SCRI	June 2004
BC 89-34-41 (Saanich)	Guard	Rooted cutting	Mid/Late	PARC	June 2003
EM 5928/114 (Malling Hestia)	Guard	Rooted cutting	Mid/Late	EMR	July 2002
Coho	Guard	Rooted cutting	Mid/Late	Oregon	July 2002
Cowichan	Guard	Rooted cutting	Mid/Late	PARC	June 2003
Wei-Rula	Guard	Rooted cutting	Late	German	June 2003
9451D-4	Guard	Micropropagated	Late	SCRI	June 2004
94455-E3	Guard	Micropropagated	Late	SCRI	June 2004
2000123A7	Guard	Micropropagated	Late	SCRI	June 2004

The trial was designed as a randomised complete block, with 15 variety entries (12 test selections and three controls, Table 1). Each variety was replicated four times (with the exception of 9062E-1, two replicates only). For most selections, each plot comprised 15 plants, spaced 0.45m apart in the row, with a 1 m guard (gap) left in each row between plots (effective plot length 7.3 m). Each row within the trial comprised (from the north end) a 2 m section planted with Glen Ample, a 1m unplanted gap, a 7.3 m plot containing a single plot guard entry, six plots of main trial entries, an empty plot or one containing a single plot guard entry, a 1m gap, and finally approximately 6m of row planted with Glen Ample.

A sown grass sward was established between the crop rows. Trickle irrigation and fertigation was supplied by a single irrigation line laid down the centre of each row. Plants were trained/supported using a vertical wall post and wire trellis, with mobile primocane support wires. All crop management and pest and disease control programmes followed those being used in the other established summer fruiting raspberry plantations on the farm.

After planting most varieties in the summer of 2002, all plants were cut back to ground level in December 2002, so that all plots were destined to crop for the first time in 2004. Some varieties were planted in July 2003, which were also allowed to crop in 2004, but produced only a small amount of fruit. In addition, module raised plants from tissue culture of Glen Ample and Tulameen arrived on site in late July 2003. These plants were very small and proved difficult to establish so were cut down to ground level in December of 2003. They .did not produce their first full crop until the summer of 2005. One of the main entries (9062-E1) from the Scottish Crop Research Institute (SCRI) proved very difficult to propagate and was not planted until June 2004 (only sufficient plants for two plots). Five additional guard entries from SCRI were also planted in June 2004. All of these late entries produced their first small crop of fruit in 2005.

Assessments

Fruit characteristics

Entries planted in 2002 and 2003 were assessed in 2005 and 2006; those planted in 2004 were assessed in 2006 only. In each year, fruit was harvested over a 7-8 week period from the last week of June until the end of the second week of August. During each harvest all of the plots in the trial were picked over every two days. The total weight of marketable fruit and that of 25 berries selected at random from the harvested fruit were recorded for each plot at every pick. The appearance of the fruit harvested from each plot was scored on a scale of 1 to 5 for a range of characteristics:

Characteristic	**Score 1**	**Score 5**
Redness	Very dark	Very pale
Brightness	Very dull	Very bright
Texture	Very soft	Very firm
Outline	Very irregular	Very even
Skin strength	Very weak	Very strong
Berry cohesiveness	Very crumbly	Very cohesive
Flavour	Very poor, acid, off-flavour	Very sweet, aromatic, fruity

Shelf life

For each week of the harvest period, two punnets of fruit harvested from each plot were selected at random and placed in cold store for two days at 3^0C. Fruit were then assessed for the presence of rotten berries, berry texture and berry appearance.

Plant characteristics

Throughout the life of the trial, all varieties/advanced selections were assessed and records collected for date of bud break; date of onset, 50% and end of harvest; frost susceptibility; primocane and fruiting cane characteristics; susceptibility to pests and diseases; general ease of plant management.

The fruiting habit of plants was also assessed during each harvest to determine lateral length, lateral angle and lateral damage.

Customer tests and sensory evaluation

During the 2005 harvest, fruit from the most promising main trial and guard entries were sent to several of the major supermarkets for their appraisal in comparison with fruit from standard varieties of the same season. In addition, in July 2005, customers visiting the Farm Shop at Rectory Farm, Stanton, St John, Oxford, were invited to assess the fruit of the entries considered to have the most promise.

Charis Food from Thought (Now Sensory Scotland Ltd) carried out sensory evaluation of samples of fruit harvested from the SCRI selections and the control varieties in 2005 and 2006.

Conclusions

The trial has identified varieties and numbered selections with potential either for immediate use by growers or future release to the industry:

- Four varieties, Malling Juno (EM 6544/80), Glen Fyne (9062E-1), Glen Doll (9053B6) and Cowichan display considerable commercial potential, producing yields and fruit quality similar to or better than the current industry standard cultivars. Some also offer improved shelf life and significant pest and/or disease resistance or tolerance.

- These varieties also display favourable plant characteristics including spine-free canes, upright habit, moderate rather than excessive or inadequate primocane production, good lateral presentation and hence ease of access to the picker. These attributes may substantially reduce the cost of crop production, picking and crop protection.

- The late but very even bud break of Glen Doll coupled with its long harvest period, make it a good replacement for Glen Ample and Tulameen during the mid- to late harvest period. Glen Doll also has considerable tolerance or

resistance to cane Botrytis and spur blight. Berries were also of a more consistent shape and cohesiveness, with a superior shelf life to standard varieties. However, Glen Doll is not recommended for early fruit production due to its extended chilling requirement to allow bud break.

- Cowichan proved to be a very robust and reliable variety to grow, harvest and market. Its key characteristics were ease of plant management, good fruit presentation, easy fruit detachment from laterals, good fruit appearance and long shelf life.

- Two advanced selections from East Malling Research planted as guards in this trial (EM 6166/89 and EM 5928/114) have also now been named Malling Minerva and Malling Hestia. These varieties were main entries and performed particularly well in earlier HDC work (SF 41). They have considerable resistance or tolerance to the main foliar, fruit and cane diseases affecting summer fruiting raspberries. They also contain the gene A^{10} conferring resistance to the feeding of four strains of the large raspberry aphid. Release of these varieties is intended primarily for plant sales to the amateur market.

- One UK propagator also intends to propagate and market plants of the Canadian selection BC 89-33-84 (now named Chemainus), which was found (as a guard entry in this trial) to produce high yields, good sized attractively coloured, glossy and very firm fruit.

Financial benefits

The future use of Malling Juno, Glen Fyne, Glen Doll and Cowichan should enable growers to continue to meet the increasingly demanding specifications set by UK supermarkets.

Malling Juno and Glen Fyne have potential for use at higher plant densities than is possible using current varieties, and this will reduce the fixed costs of establishment.

Because of their agronomic performance and pest and disease resistance, considerable cost savings could be achieved by growing these new varieties.

Action points for growers

- Growers should consider planting these new varieties on a trial basis at least to compare them with varieties they are currently growing.

Science Section

Introduction

Since they became available for commercial planting in the late 1980s, the mid-season summer fruiting raspberry cultivars Glen Ample from the Scottish Crop Research Institute (SCRI) and Tulameen from the Pacific AgriFood Research Centre (PARC) in Canada have dominated the UK industry. More recently they have been joined by the late-summer fruiting variety Octavia, a product of the East Malling Research (EMR) raspberry breeding programme. If planted in the open field, these three cultivars currently enable quality fruit to be produced from late June/early July to early August.

Unfortunately both Glen Ample and Tulameen exhibit marked failings, particularly with regard to lack of resistance to pest and disease and occasional imperfect berry set, shape and post-harvest life. Primo and floricane management can also be difficult with both of these cultivars and in the case of Glen Ample, the unexplainable loss of plant vigour within two or three years of planting has led to a greatly reduced plantation life on some sites.

The aim of this work was to assess the performance of a number of new summer fruiting raspberry varieties in a commercial plantation. Some of these had previously been assessed by the Scottish and East Malling Raspberry Breeding Consortia, to which HDC belonged. The intention was to identify varieties with potential to compliment or replace the existing summer fruiting varieties currently been grown in the industry.

Materials and Methods

Site description and preparation for planting

The site, facilities including staff to pick the trial were made available by kind permission of The Rt. Hon. Richard Stanley at Manor Farm, Forest Hill, Oxford.

The field used was gently sloping and facing due south. It was sheltered to the north and east but exposed to the south and southwest wind. On the farm, this was considered to be one of the earliest cropping fields. This was reflected in bud break, flowering and the onset of harvest throughout the life of the trial which was consistently earlier in this field than any of the other raspberry plantations on the farm. Unfortunately, this also caused the trial in its second cropping year to be subject to severe damage by spring frosts in April and May 2005. This caused considerable fruit bud loss and hence lack of fruit set for that season for the majority of entries planted in the trial.

The soil of the trial site was a sandy clay loam to depth, alluvial in origin. Drainage was adequate under most weather conditions but could be imperfect in the lower sections of the site during periods of very heavy rainfall. It was also discovered two years after planting that there was a spring line half way down the site.

Prior to planting the land was in permanent pasture, followed by set aside. The grass sward of a large section of the field to the east of the trial site was cleared in spring 1998, and then planted with summer fruiting raspberries in the early part of 1999. This cropped area was extended in 2001 to accommodate the trial site to the west of the existing plantation. The grass sward was cleared using two applications of Roundup (glyphosate) at respectively 5 and 4 litres/ha, the first in April the second in October. Pre-cultivation soil samples were taken to determine the free living nematode and nutritional status of the soil (Table 2). On the basis of these results, the base fertilizer application to the site was 5 tones/ha of ground chalk, 60 kg/ha of phosphate, 100 kg/ha of potash and 100 kg/ha of magnesium.

Table 2. Pre-cropping nutritional status (mg/l indices in parentheses) of the trial site and results of free-living nematode (*Pratylenchus*, *Longidorus* and *Xiphinema*) counts (nematodes/litre of soil)

pH	Phosphorus	Potassium	Magnesium	Free-living nematodes
6.0	17 (2)	110 (1)	40 (1)	0

Just prior to planting the soil was cleared of annual weed by the overall application of paraquat + diquat applied at the rate of 4litres/ha. The site was then sub-soiled,

ploughed, cultivated and the soil in each individual crop row pulled up to form a ridge approximately 0.45m in width and 0.30m in height. All plantings were on raised polymulch covered raised beds with a grass sward allowed to establish down the alleyways of the plantation.

Planting

The main entries and guard entries planted in the trial and their date of planting are summarised in Table 3.

Table 3. Selections planted, source and seasonal position (type) and planting date of raspberries in the trial area

Selection	Included as	Propagation method	Type	Source	Planting date
Glen Moy (control)	Main entry	Rooted cutting	Early	SCRI	July 2002
EM 6390/47	Main entry	Rooted cutting	Early	EMR	July 2002/03
EM 6544/80 (Malling Juno)	Main entry	Rooted cutting	Early	EMR	July 2002
Glen Ample (control)	Main entry	Rooted cutting	Mid	SCRI	July 2002
Glen Ample (control)	Main entry	Micropropagated	Mid	SCRI	July 2002
EM 6545/12	Main entry		Mid	EMR	July 2002
9059D-2	Main entry	Micropropagated	Mid	SCRI	July 2002
9062-E1 (Glen Fyne)	Main entry	Micropropagated	Mid	SCRI	June 2004
9050RD3	Main entry	Micropropagated	Mid	SCRI	July 2002
9046RA2	Main entry	Micropropagated	Mid	SCRI	July 2002
Tulameen (control)	Main entry	Rooted cutting	Mid/Late	PARC	July 2002
Tulameen (control)	Main entry	Micropropagated	Mid/Late	SCRI	June 2003
EM 6428/1	Main entry	Rooted cutting	Mid/Late	EMR	July 2002
EM 6506/37	Main entry	Rooted cutting	Mid/Late	EMR	July 2002
9053B6 (Glen Doll)	Main entry	Micropropagated	Mid/Late	SCRI	July 2002
EM 6385/1	Main entry	Rooted cutting	Late	EMR	July 2002
EM 6512/50 (Octavia)	Main entry	Rooted cutting	Late	EMR	July 2002
EM 6413/59	Guard	Rooted cutting	Early	EMR	July 2002
BC 89-2-89 (Esquimalt)	Guard	Rooted cutting	Early	PARC	June 2003
EM 6166/89 (Malling Minerva)	Guard	Rooted cutting	Mid	EMR	July 2002
BC 89-33-84 (Chemainus)	Guard	Rooted cutting	Mid	PARC	July 2002
BC 90-8-20	Guard	Rooted cutting	Mid	PARC	June 2003
Rubaca	Guard	Rooted cutting	Mid	German	June 2003
Kitsilano	Guard	Rooted cutting	Mid	PARC	July 2002
BC 90-8-11	Guard	Rooted cutting	Mid	PARC	June 2003
EM 6507/35	Guard	Rooted cutting	Mid	EMR	July 2002
EM 6487/74	Guard	Rooted cutting	Mid	EMR	July 2002

9612F-2	Guard	Micropropagated	Mid	SCRI	June 2004
9751E-2	Guard	Micropropagated	Mid	SCRI	June 2004
BC 89-34-41 (Saanich)	Guard	Rooted cutting	Mid/Late	PARC	June 2003
EM 5928/114			Mid/Late	EMR	
(Malling Hestia)	Guard	Rooted cutting			July 2002
Coho	Guard	Rooted cutting	Mid/Late	Oregon	July 2002
Cowichan	Guard	Rooted cutting	Mid/Late	PARC	June 2003
Wei-Rula	Guard	Rooted cutting	Late	German	June 2003
9451D-4	Guard	Micropropagated	Late	SCRI	June 2004
94455-E3	Guard	Micropropagated	Late	SCRI	June 2004
2000123A7	Guard	Micropropagated	Late	SCRI	June 2004

Care should be taken when interpreting the season of production for each variety listed. The categorisation of each variety has been based on the season of production recorded in this trial alone and not on any other trial results or commercial experience.

The first plants for the trial were supplied in early July 2002 by East Malling Research as well -grown module raised plants, which were propagated from shoot cuttings, taken from root cuttings in March and April of that year. In the majority of cases these plants when delivered to the site consisted of a single primocane at least 0.30 m and in some cases 0.50 m in height arising from a considerable root system. East Malling were able to supply the majority of the plants of the advanced EM selections to be planted as main and single plot guard entries in the trial, along with plants of the industry standards cultivars, Glen Moy, Glen Ample and Tulameen. However due to there being insufficient or no root being available, only two plots of the main entry EM 6390/47 were planted in July 2002. The plants for the remaining plots of this selection and also for the guard entries Rubaca, Cowichan, BC 90-8-20, BC 90-8-11, BC 89-34-41 (Saanich), BC 89-2-89 (Esquimalt) and EM 6495/53 were not available from East Malling Research until early July 2003.

SCRI supplied parent material for their main entries to the Scottish Agricultural College (SAC) for propagation. These were as supplied as micropropagated parent material instead of root cuttings as ordered. These plants were exceptionally small when delivered for planting in late July 2002. Each had a poorly developed root system and a single primocane of less than 20 cm in height. Due to problems with their micropropagation, only four of the five main entries, and none of the guard entries, from SCRI could be supplied for planting in July 2002 (Table 3). The remaining main entry (9062E-1, sufficient plants for 2 rather than 4 plots) and the guards were eventually supplied in June 2004 (Table 3).

All planting was by done by hand. Plants were individually watered immediately after planting and two days after planting. Thereafter, water and fertiliser was applied via a trickle irrigation line laid down onto the surface of the soil down the length of each crop row. All plants received the same irrigation and fertigation programme as the adjacent fully cropping summer fruiting raspberry plantation until the end of their planting year.

Post-planting in summer 2002, the plants were sprayed with Aphox (pirimicarb) in late August for control of large raspberry aphid and in October with Recoil (mancozeb + oxadixyl) to protect them from infection by *Phytophthora* root rot. The latter treatment was applied as in the autumn 2002 *Phytophthora idaei* (as confirmed by CSL Plant Diagnostics) caused the collapse and later death of some of the plants in one of the four plots of the standard cultivar Glen Moy supplied by EMR. In 2004 *Phytophthora rubi* infection was also confirmed as affecting and causing the death of plants planted in and adjacent to the trial site.

As the SCRI trial entries had been micropropagated, direct comparison of their performance could not be made with the standard cultivars Glen Moy, Glen Ample and Tulameen that had been derived from root/shoot cutting. It was therefore decided to plant additional plots of Glen Ample and Tulameen as plants directly from micropropagation. These were not available until June 2003.

Trial design

The trial was a randomised complete block design, with 15 variety entries (12 test selections and three controls, Table 1) each replicated four times (with the exception of 9062E-1, two replicates only) within the experimental area. For most selections, each plot comprised 15 plants, spaced 0.45m apart in the row, with a 1 m guard (gap) left in each row between plots (effective plot length 7.3 m). Each row within the trial comprised (from the north end) a 2 m section planted with Glen Ample, a 1m unplanted gap, a 7.3 m plot containing a single plot guard entry, six plots of main trial entries, an empty plot or one containing a single plot guard entry, a 1m gap, and finally approximately 6m of row planted with Glen Ample.

Crop management 2003 - 2006

General agronomy & weed control

A grass only seed mix was also sown down each of the alleyways in spring 2003 to establish a hard wearing surface for machinery and pickers to work on. This also provided effective control of deep rooted perennial weeds in the alleys which had been in difficult to control in the summer of 2002. Trickle irrigation and fertigation was supplied by a single irrigation line laid down the centre of each row.

After all the canes had been cut back in December 2002, the crop rows were mulched with black polythene through which the primocane produced by each plant could grow. This not only provided very effective weed control in the crop rows, but also allowed each plant in the plots to be grown in isolation to that around it. The fruit yield obtained by the various entries no matter how many plants were present in each plot could be expressed as kg/plant.

To prevent, perennial and annual weed germination alongside the edges of the beds and their ingress onto the beds from the grassed down alleys, a 0.3 m wide band of soil running along the edge of the base of each side of the polymulch-covered ridges (on which the raspberries were planted) was treated with herbicide applied as a carefully directed and shielded spray in January 2003, 2004, 2005 and 2006. The product combination used on each occasion was Ronstar (oxadiazon) @ 8L/ha + Kerb Flo (propyzamide) @ 2.5L /treated ha and PDQ (paraquat + diquat) @ 4L/ha applied in 400L of water/ha. Weed removal from around individual plants in the crop rows was done by hand as in the spring, summer or autumn.

A traditional vertical wall support trellis was erected down each of the rows (including the guard rows) in February 2003. Posts were 2.4 m long (5 to 7 cm circumference) spaced 7 m apart in the row. Braced end-posts were also 2.4 m long but had a circumference of 12 to 14 cm. Two wires (1.2 m and 1.8 m above the ground), each fitted with strainers, were run the full length of each row. A single pair of loose wires with 0.45 m lengths of lightweight chain attached to their ends was run to either side of each row. These mobile wires were laid into three lines of hook nails driven into the outward (alleyway) face of the support posts at 0.45, 0.9 and 1.6 m above the ground. These were used to support the current season's primocane

securely against the floricane from May to September. This ensured the primocane was out of the way of pickers, safe from damage and allowed free access to machinery down the alley ways.

As a result of damage to some plants by rabbits in the early spring of 2003, a protective wire mesh fence was erected around the trial.

All plants were cut back to one or two buds above ground level in December 2002, so that all those planted during the summer of 2002 fruited (i.e. produced their first full crop) in 2004. Those varieties planted in July 2003 were also allowed to crop in 2004, but produced only a small amount of fruit. Module-raised plants from tissue culture of Glen Ample and Tulameen arrived on site in late July 2003 (these are not included in Table 3). These plants were very small and proved difficult to establish so were cut down to ground level in December of 2003. They did not produce their first and a full crop until the summer of 2005. Those entries planted in 2004 (Table 3) produced their first small crop of fruit in 2005.

Primocane management, except during the spring of 2005, was done by hand in the spring pre- and during blossom and again post-harvest. The aim was to retain no more than eight canes per m length of crop row or 3-4 canes per plant to crop each year. In spring 2005, serious frost damage occurred to newly-emerged primocane in the majority of the trial plots. In mid-April 2005, a directed, shielded application of sodium monochloroacetate plus the wetter Wayfarer was applied around the bases of the floricane to fully cover the damaged primocane. This removed the majority of the damaged primocane but also damaged some of the floricane, where frost had caused the canes rind to split and to expose underlying cortical tissue. An overhead sprinkler system was subsequently installed to provide the crop with frost protection.

As soon as possible post-harvest (late August 2004, 2005 and 2006) all spent fruiting canes were cut through as close as possible to ground level. The debris was removed from the crop rows and pulverised *in situ* along with any unwanted primocane which had been removed from around each plant at the same time. The remaining primocane in the rows were then held upright and prevented from rocking or rubbing on each other by the pair of mobile wires fitted to the support trellis now being pulled upwards and placed at their highest position 1.8m above the

ground. The wires were pulled up tight and clipped together at several points between each set of the trellis support posts.

Final primocane selection and lacing into the two fixed support wires at 1.2 and 1.8m from the ground took place each year in November or December post leaf-fall when the cane rind was considered to be sufficiently hardened. At this stage the mobile support wires were lower to 0.9m above the ground where they remained until May of the following growing season.

Pest & disease management

In the early autumn of the planting year the presence of *Phytophthora idaei*, was confirmed in one of the four plots of Glen Moy. By late summer of 2003, all of the plants in two of the plots of this cultivar were dead and the plants in several plots predominantly in the replicate where this disease had first been identified were displaying typical symptoms of *Phytophthora* root rot. CSL Plant Diagnostics and SERAD examined affected plants in the autumn of 2003 and the presence of both *Phytophthora fragariae* var. *rubi* and *Phytophthora idaei* were confirmed. Despite all actions being taken to reduce the spread of root rot across the site, initially by the application of Recoil (mancozeb + oxadixyl) in autumn 2002 and spring 2003, then SL567A (metalaxyl-M) in autumn 2003 and spring 2004 and thereafter Shirlan (fluazinam) every autumn and spring, by summer 2005 virtually all the plants in the plots of one replicate had been lost. Further losses of plants in both guard and main trial plots were incurred during the winter of 2005 and spring of 2006. By the summer of 2006 fruit was only being harvested from the plots in two replicates and a few of the guard entries.

All other pest and disease control measures applied to the trial site throughout its life were as per the other plantations on the farm:

Cane and fruit botrytis, spur blight and cane spot: - alternating applications every 10 days of Unicrop Thianosan DG (thiram) and Elvaron Multi (tolyfluanid). Applications started at full bud break of floricane/early emergence of primocane and continued until 7-10 days before the onset of harvest

Raspberry beetle: chlorpyrifos (various products) applied at late green bud

Raspberry cane midge: chlorpyrifos applied as a carefully directed spray onto the primocane growing around the base of the floricane. One application applied 5-7 days after the expected date of adult midge emergence from the soil of the site, as per indicated by the ADAS raspberry cane midge emergence prediction service.

Other applications of fungicides, insecticides or acaricides were also made during the life of the trial when necessary to control of raspberry rust, large raspberry aphid, two spotted spider mite and adult vine weevil.

Crop nutrition

Soil samples were taken from the crop rows and the nutrient levels of the soil determined in January 2003, 2004, 2005 and 2006. From these results appropriate top dressings of phosphate, potash and magnesium were applied over the raised beds and thereby some onto the soil surface of the planting hole of each plant. This was followed by an annual top dressing of 30 kg/treated ha of nitrogen, just prior to the onset of plant growth, again applied onto the surface of the polymulch covering the soil in the crop rows.

All other nutritional needs of the plants were supplied via fertigation during the period early May to mid-September. Annually, this amounted to 60 kg/ha of nitrogen, 12 kg/ha of phosphorus, 120 kg/ha of potassium and 10 kg/ha of magnesium.

Harvesting and record keeping

Fruit quality

All supervision and harvesting (by hand) was done by the host farm's staff. Harvesting each year commencing during the last week of June and was completed in the second or early during the third week of August. Picking was done every two days, with all ripe fruit being removed from the plants on each occasion. The weight (kg) of marketable fruit was recorded for each plot. In addition, at every picking, the weight (g) of 25 fruits selected at random from the fruit picked from each plot was recorded.

Once per week, (on Mondays) throughout every harvest the appearance of the fruit harvested from each plot was assessed on a 1-5 scoring basis for a range of characteristics. These were:

- Redness (1 = very dark, 5 = very pale)
- Brightness (1= very dull, 5 = very bright)
- Outline (1 = very irregular in shape, 5 = very even in shape)
- Texture (1 = very soft, 5 + very firm)
- Skin Strength (1 = very weak easily ruptured, 5 = very strong)
- Berry cohesiveness (1 = very crumbly lacks cohesiveness, 5 = whole very cohesive fruit)
- Flavour (1 = very poor weak, acid, off flavour, 5 = very good, sweet, aromatic, fruity)

Brief notes were also made of berry shape, colour, flavour and appearance in the punnet, to build up a picture of the consistency of marketable qualities of the fruit of each of the entries in the trial throughout their harvest period.

Shelf-life

Once per week (on Mondays), throughout each harvest, when adequate quantities of fruit were available, two punnets of fruit harvested from each plot were selected at random and placed in cold store for two days at 3^0C. When withdrawn from

storage (on Wednesdays) the fruit was assessed, on a 1-5 scoring basis for a range of shelf-life characteristics. These were:

- The presence of rotten berries (1 = 5 or more rotten fruits present, 5 = no rotten fruit)
- Berry texture (1 = completely collapsed and unmarketable, 5 = as picked)
- Berry appearance (1 = very dull, poor unacceptable appearance, 5 = very bright, fresh, attractive appearance)

Market acceptability

During the 2005 harvest, fruit (when available) of the most promising main trial and guard entries was submitted to the fruit technologists of major UK supermarkets (Tesco, Sainsburys, Marks & Spencer and Waitrose) for evaluation. Fruit were compared with samples from the current in-season standard cultivars, Tulameen, Glen Ample and Octavia.

Technologists were asked to comment on the market acceptability of the fruit and to score them on a 1-5 scale for:

- Appearance (1 = very dull, poor unacceptable appearance, 5 = very bright, fresh, attractive appearance)
- Flavour (1 = very poor weak, acid, off flavour, 5 = very good, sweet, aromatic, fruity)
- Firmness (1 = very soft, 5 + very firm)

In 2005 customers of Rectory Fruit Farm shop, were invited to assess and compare in season the entries considered to have the most promise alongside the cultivars that they were used to picking. Customers were provided with the fruit of two trial entries (main and or guards) and of one in-season standard cultivar (Glen Moy, Glen Ample or Tulameen). The fruit samples were labeled A, B and C and participants were asked to insert Y (yes) or N (no) under the questions on the evaluation forms which accompanied each batch of fruit. The questions were:

- Do you like this variety's appearance (Yes or No)
- Do you like the fruits texture (Yes or No)
- Do you like the fruits flavour (Yes or No)

- Would you buy this variety (Yes or No)

Over a 4 day period, over 300 customers participated in the assessment of several batches of fruit placed next to the check-out of the farm shop.

Sensory evaluation

Samples of fruit harvested from the SCRI trial entries were supplied along with fruit of Glen Ample and Tulameen also harvested from the trial, to Charis Food from Thought on the 17 July 2005 and Sensory Scotland Ltd on the 18 July 2006. These were subjected to a full sensory appraisal, carried out by a professional panel. The characteristics evaluated by the sensory panels on a 1-100 (1= poor, 100 = excellent) scale were:

- Appearance (colour, uniformity of appearance and berry size)
- Flavour (fruitiness, sweetness, woodiness, acid/sourness balance, raspberry, grassy, bitter, floral)
- Aftertaste (intensity, persistence)
- Mouthfeel (firmness, seediness, juiciness)
- Overall acceptability

Grower assessment at Open Days

On the 6 July 2004 and 14 July 2006 HDC grower members, consultants, plant breeders, propagators and fruit technologists from UK supermarkets were able to attend an open day at the site. In addition to viewing the plants of the selections and varieties in the field, attendees were requested to carry out an assessment of samples of fruit harvested from the trial selected from the (then) most promising main and guard entries, in comparison with fruit of the standards Glen Moy, Glen Ample and Tulameen. Participants were asked to score fruit as follows:

The berry quality appraisal was carried out on a 1-5 scoring basis:

- Redness (1 = very dark, 5 = very pale)
- Brightness (1= very dull, 5 = very bright)
- Texture (1 = very soft, 5 + very firm)

- Flavour (1 = very poor weak, acid, off-flavour, 5 = very good, sweet, aromatic, fruity)

Lastly participants were asked to say whether or not they considered that each entry had commercial potential.

Fruit of Malling Juno and several other entries from EMR were supplied to Meiosis Ltd for display at Fruit Focus in 2004 and fruit of Glen Doll and Glen Fyne to SCRI for appraisal by visitors to the station open days held in July 2005 and 2006.

Fruiting cane characteristics

During the 2004 and 2005 harvest, the fruiting habit of laterals on the fruiting cane of each entry was assessed as follows:

- Lateral length: basal laterals (1= very long, 5 = very short); upper laterals (1= very long, 5 = very short)
- Lateral angle: basal laterals (1= drooping, 5 = strongly ascending); upper laterals (1= drooping, 5 = strongly ascending)
- Lateral damage (strength): (1 = many broken, 5 = none broken at time of assessment)

Throughout the life of the trial, the following additional data were collected for each entry:

- Date of bud break
- Date of onset, 50% and end of harvest
- Susceptibility to frost
- Primo and fruiting cane characteristics (cane habit, number, spines, height, average number/m of row, diameter, levels of splitting of cane rind, foliar density, bud number)
- Susceptibility to cane, foliar and fruit pests and diseases (April 2004 & 2005)
- Ease of detachment of fruit from receptacle
- General ease of plant management

Results

Main entries

Yield

The dates of harvest and yields obtained from the main entries in each of the three harvest years (2004, 2005 and 2006) are given in Tables 2, 3 and 4 respectively. Dates of harvest and yields in each year reflected the prevailing weather conditions during the winter, spring and summer prior to harvest.

The 2003/04 winter was generally cold and spring 2004 was cool, resulting in slow bud break and lateral development. This was followed by warm dry weather during flowering, fruit development and throughout most of the harvest period. Harvest was early (also in part reflecting the age of the plants), protracted and high yields of fruit obtained from many of the entries (Table 2).

In contrast the winter of 2004/05 was exceptionally mild, which encouraged early bud break of the majority of the entries in the trial. However, frost in late April, mid-May and late May resulted in considerable cold injury to buds, fruiting laterals and flowers. The weather at the onset of harvest was warm and dry, but was followed by two storms with heavy rain in mid- July. Hot, dry weather prevailed for the remainder of harvest period. As a result, most of the early and main season fruiting cultivars and selections produced far less marketable fruit than the previous season. The severity of frost damage in May to the primary flowers and whole laterals of many of the entries meant that they produced secondary and in some cases tertiary laterals. These produced the majority of the crop and resulted in a very protracted harvest.

The winter of 2005/6 was very dry with above average temperatures. The spring was cool and wet during May and into early June. However from late June until the end of harvest, the temperatures were very high and at times well above average. These conditions produced a harvest 11days shorter than the previous year.

Table 2. Harvest period and average yield (kg/plant) per plant of main entries in 2004

Variety/ Selection	Harvest date				Yield (kg/plant)
	1st pick	50% pick	75% pick	Last pick	
EM 6385/1 ®	29 June	22 July	27 July	11 August	1.74
EM 6390/47 ®	19 June	2 July	12 July	7 August	1.92
EM6428/1®	29 June	20 July	27 July	11 August	2.82
EM 6506/37 ®	25 June	17 July	22 July	13 August	3.17
EM 6512/50 ® (Octavia)	30 June	25 July	1 August	15 August	2.27
EM 6544/80 ® (Malling Juno)	21 June	5 July	12 July	6 August	2.18
EM 6545/12 ®	25 June	12 July	20 July	6 August	2.18
Glen Moy ®	18 June	5 July	14 July	22 July	2.46
Glen Ample®	22 June	14 July	20 July	8 August	2.43
Tulameen ®	28 June	20 July	25 July	12 August	2.77
9059D-2 (M)	21 June	12 July	20 July	15 August	2.73
* 9062E-1 (M) (Glen Fyne)	-	-	-	-	-
9050RD3 (M)	25 June	14 July	20 July	20 July	1.48
9046RA2 (M)	25 June	12 July	20 July	13 August	1.89
9053B6 (M) (Glen Doll)	25 June	20 July	27 July	15 August	2.98
** Glen Ample (M)	-	-	-	-	-
** Tulameen (M)	-	-	-	-	-
				P	<0.001
				SED (32df)	0.34

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

2004 comments

9053B6 (Glen Doll) had a very long harvest period in 2004, the last fruit of this entry (and Octavia) being harvested on 15 August. EM6506/37, 9053B6 (Glen Doll) and EM6428/1 produced the highest marketable yield in 2004, followed by Tulameen, 9059D-2, Glen Ample and Glen Moy.

EM6390/47 and EM6544/80 (Malling Juno) were the earliest fruiting varieties with harvest periods very similar to Glen Moy. The yield (kg/plant) of these selections was however lower than that of Glen Moy. Although the first fruit of 9059D-2 were picked on the same date as that of EM6544/80 (Malling Juno) the 50 and 75% pick date of this entry was similar to the mid-season cultivar Glen Ample.

The harvest periods of EM6506/37, EM6545/12, 9050RD3 and 9046RA2 were very similar to that of Glen Ample. 9050B6 (Glen Doll) had a similar harvest period to Tulameen. The first fruit of EM6385/1 and EM6428/1 were picked on the 29 June, one day after Tulameen and one day before Octavia. However the 50 and 75% pick dates of these selections was very similar to Tulameen, so these EMR entries should be considered to be mid- rather than late mid- season fruiting varieties.

2005 comments

In 2005, EM6544/80 (Malling Juno), EM6545/12 and 9046RA2 were the first entries to be picked, two days in advance of Glen Moy. They also reached their 75% pick date nine, seven and two days respectively before Glen Moy. However the marketable yield of these entries was below that of Glen Moy.

The first fruit of EM6390/47 and 9059D-2 were picked on the same day; their 50% pick dates were respectively five after and two days before Glen Moy. The 75% pick dates was two days before (EM6390/47) and two days after (9059D-2) Glen Moy. The marketable yield of both of these entries was slightly above that of Glen Moy.

Harvesting of fruit from the micro-propagated Tulameen and Glen Ample commenced on 1 July and the 50 and 75% pick dates were very similar to that of Glen Moy. The harvest of these cultivars derived from root cuttings commenced and reaching 50 and 75% pick dates somewhat later.

As in 2004, 9053B6 (Glen Doll) had an extremely long harvest period with the first fruit picked five days before and the last on the same day as Octavia. 9053B6 (Glen Doll), Glen Ample (micro-propagated), 9059D-2, Glen Moy, Glen Ample (root cuttings) produced the highest and EM6544/80 and 9062E-1 (Glen Fyne) the lowest yield of marketable fruit. However in the case of 9062E-1 this reflected the age of the plants, having been planted in July 2004. Fruit was borne on only a very small number of rather short canes in each plot.

The low yield achieved by EM6506/37 and EM6428/1 was as a result of the weakening of and loss of plants in some of the plots of these selections by *Phytophthora idaei* and/or *Phytophthora rubi*. Although its harvest started at the same time, the 50%, 75% and last pick dates of EM6428/1 were in advance of Octavia, so as regards its picking season this selection cannot be considered to be potential replacement for Octavia.

2006 Comments

Yields were considerably lower overall than in the previous years as either *Phytophthora idaei* and or *Phytophthora rubi* had caused the death of all of the plants in one plot and had killed or at least substantially weakened plants in at least two of the remaining three plots of all the main entries in the trial. All the plants in the plots of 9050RD3 were dead by spring 2006.

Of the early fruiting selections, EM6544/80 (Malling Juno) produced the highest yield. As in previous years its harvest commenced at the same time as Glen Moy, EM6390/47 and EM6545/12 but in 2006 its 75% pick date was reached in advance of these other entries.

For the mid- and late season varieties, the highest yield in 2006 was achieved by Glen Fyne, (micro-propagated) Glen Ample, Glen Doll and Tulameen (rooted cuttings).

Table 3. Harvest period and average yield (kg/plant) per plant of main entries in 2005

Variety/ Selection	Harvest date				Yield (kg/plant)
	1st pick	50% pick	75% pick	Last pick	
EM 6385/1 ®	29 June	17 July	26 July	11 August	1.39
EM 6390/47 ®	29 June	26 July	30 July	16 August	1.61
EM6428/1®	4 July	26 July	2 August	16 August	1.23
EM 6506/37 ®	1 July	26 July	30 July	14 August	1.43
EM 6512/50 ®(Octavia)	4 July	2 August	9 August	18 August	1.65
EM 6544/80 ® (Malling Juno)	27 June	10 July	21 July	14 August	1.04
EM 6545/12 ®	27 June	14 July	21 July	11 August	1.63
Glen Moy ®	29 June	21 July	28 July	14 August	1.92
Glen Ample®	1 July	26 July	2 August	18 August	1.82
Tulameen ®	1 July	23 July	30 July	14 August	1.56
9059D-2 (M)	29 June	19 July	26 July	11 August	1.94
* 9062E-1 (M) (Glen Fyne)	27 June	23 July	2 August	18 August	1.08*
9050RD3 (M)	-	-	-	-	-
9046RA2 (M)	27 June	17 July	26 July	11 August	1.78
9053B6 (M) (Glen Doll)	29 June	26 July	2 August	18 August	2.32
** Glen Ample (M)	29 June	22 July	28 July	18 August	2.10
** Tulameen (M)	29 June	20 July	26 July	18 August	1.71
				P	<0.001
				SED (32df)	0.27

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

Table 4. Harvest period and average yield (kg/plant) per plant of main entries in 2006

Variety/ Selection	Harvest date				Yield (kg/plant)
	1st pick	50% pick	75% pick	Last pick	
EM 6385/1 ®	26 June	13 July	17 July	31 July	0.39
EM 6390/47 ®	26 June	30 June	7 July	7 August	1.27
EM6428/1®	30 June	21 July	25 July	7 August	1.44
EM 6506/37 ®	28 June	13 July	19 July	31 July	0.43
EM 6512/50 ®(Octavia)	2 July	23 July	27 July	7 August	0.89
EM 6544/80 ® (Malling Juno)	26 June	5 July	9 July	31 July	1.38
EM 6545/12 ®	26 June	7 July	15 July	7 August	1.21
Glen Moy ®	26 June	3 July	11 July	7 August	1.18
Glen Ample®	26 June	13 July	19 July	31 July	1.40
Tulameen ®	26 June	17 July	23 July	7 August	1.87
9059D-2 (M)	26 June	11 July	19 July	7 August	1.46
* 9062E-1 (M) (Glen Fyne)	26 June	17 July	23 July	7 August	2.14*
9050RD3 (M)	-	-	-	-	-
9046RA2 (M)	26 June	11 July	17 July	31 July	1.01
9053B6 (M) (Glen Doll)	26 June	19 July	23 July	7 August	1.76
** Glen Ample (M)	26 June	17 July	23 July	7 August	1.91
** Tulameen (M)	30 June	15 July	21 July	7 August	1.09
				P	<0.001
				SED (32df)	0.33

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

Berry weight

Mean berry weights for each of the three harvest years are given in Tables 5, 6 and 7. As with yield, the berry weight of the majority of the main entries in the trial was affected by the weather conditions of the spring and early summer months. The highest weights were achieved in 2004 (Table 5) and the lowest in 2006 (Table 7). In 2006, the exceptionally high daily temperatures, from soon after the start until the end of harvest, causing very rapid and often premature fruit ripening.

Table 5. Mean berry weight (g) of main entries in 2004.

	At pick stage					
Variety/selection	**25%**	**50%**	**75%**	**Minimum**	**Maximum**	**Average for harvest**
EM 6385/1 ®	3.35	3.41	2.84	2.51	4.03	3.29
EM 6390/47 ®	3.76	3.66	4.11	2.96	6.68	3.76
EM6428/1®	4.55	4.29	4.36	3.62	5.05	4.30
EM 6506/37 ®	5.31	4.88	5.84	4.12	6.13	5.11
EM 6512/50 ® (Octavia)	5.30	4.83	4.32	4.12	5.99	5.00
EM 6544/80 ® (Malling Juno)	3.10	3.20	3.20	2.45	3.70	3.29
EM 6545/12 ®	3.08	3.12	3.11	2.46	3.32	2.95
Glen Moy ®	3.25	3.51	3.00	3.00	4.68	3.67
Glen Ample®	4.47	4.12	4.10	3.44	4.81	4.30
Tulameen ®	4.61	4.74	5.14	3.76	5.14	4.54
9059D-2 (M)	4.70	4.69	4.82	3.28	5.39	4.40
9062E-1 (M) (Glen Fyne)	-	-	-	-	-	-
9050RD3 (M)	2.88	2.8	3.94	2.8	3.94	3.33
9046RA2 (M)	3.35	3.42	3.74	3.20	3.90	3.56
9053B6 (M) (Glen Doll)	4.92	4.82	4.36	3.14	5.41	4.35

Glen Ample (M)	-	-	-	-	-	-
Tulameen (M)	-	-	-	-	-	-
					P	<0.001
					SED(31df)	0.360

® Plants propagated from root cuttings

(M) Micropropagated plants

Table 6. Mean berry weight (g) of main entries in 2005.

	At pick stage					
Variety/selection	**25%**	**50%**	**75%**	**Minimum**	**Maximum**	**Average for harvest**
EM 6385/1 ®	2.76	3.11	3.4	2.63	3.92	3.11
EM 6390/47 ®	3.43	3.43	3.07	2.48	4.12	3.29
EM6428/1®	3.92	5.09	4.67	2.48	5.09	3.95
EM 6506/37 ®	4.61	4.47	4.17	2.88	5.02	4.14
EM 6512/50 ® (Octavia)	5.36	4.89	3.88	3.20	5.36	4.43
EM 6544/80 ® (Malling Juno)	3.61	3.08	3.50	2.80	4.00	3.30
EM 6545/12 ®	2.52	2.92	2.76	2.18	3.18	2.68
Glen Moy ®	3.86	4.08	4.10	2.96	4.92	3.93
Glen Ample®	3.66	4.5	4.06	2.90	5.20	3.95
Tulameen ®	4.54	4.12	4.32	3.14	4.72	4.07
9059D-2 (M)	3.98	3.52	4.02	2.52	4.62	3.67
9062E-1 (M) (Glen Fyne)	4.64	3.84	4.42	3.40	5.56	4.29
9050RD3 (M)	-	-	-	-	-	-
9046RA2 (M)	3.04	3.16	3.44	2.72	3.84	3.20
9053B6 (M) (Glen Doll)	4.28	4.80	4.16	3.11	4.80	4.01
Glen Ample (M)	4.95	3.95	4.14	3.79	6.44	4.31
Tulameen (M)	3.53	3.51	3.93	3.07	4.40	3.63
					P	<0.001
					SED (23 df)	0.270

® Plants propagated from root cuttings

(M) Micropropagated plants

Table 7. Mean berry weight (g) of main entries in 2006.

Variety/selection	At pick stage 25%	50%	75%	Minimum	Maximum	Average for harvest
EM 6385/1 ®	2.69	3.08	3.00	2.34	3.08	2.80
EM 6390/47 ®	2.91	2.67	2.52	2.04	3.23	2.61
EM6428/1®	3.51	3.94	3.74	3.01	4.42	3.61
EM 6506/37 ®	3.67	3.95	4.28	2.00	4.56	4.05
EM 6512/50 ® (Octavia)	4.23	4.36	4.26	3.70	5.14	4.20
EM 6544/80 ® (Malling Juno)	3.17	2.38	2.33	1.58	3.66	2.66
EM 6545/12 ®	2.41	2.62	2.4	2.10	2.84	2.48
Glen Moy ®	3.48	2.42	2.66	2.12	4.08	3.23
Glen Ample®	3.46	3.51	3.97	2.78	4.44	3.62
Tulameen ®	4.04	3.97	3.78	2.80	4.24	3.69
9059D-2 (M)	4.19	3.78	3.75	3.08	4.68	3.79
9062E-1 (M) (Glen Fyne)	3.59	3.77	4.02	3.12	4.64	3.74
9050RD3 (M)	-	-	-	-	-	-
9046RA2 (M)	3.04	3.19	3.61	2.48	4.08	3.21
9053B6 (M) (Glen Doll)	3.52	4.18	3.77	2.92	4.42	3.64
Glen Ample (M)	3.84	4.28	4.64	3.46	4.76	4.02
Tulameen (M)	3.62	4.14	3.93	3.08	4.24	3.74
					P	<0.001
					SED (23 df)	0.250

® Plants propagated from root cuttings

(M) Micropropagated plants

2004 comments

EM6506/37 and Octavia produced fruit with weights of >5 g throughout their harvest period, with maximum and average berry weights of 6.13 and 5.11g (EM6506/37) and 5.99 and 5.0 g (Octavia). Both displayed a steady decline of berry size through their harvest. In contrast, the fruit of EM6545/12 was unacceptably small throughout

its harvest. The fruit of EM6385/1, EM6544/80 (Malling Juno) and 9050RD3 was on average smaller than that of Glen Moy. The fruit of 9053B6 (Glen Doll), 9059D-2, 9046RA2 and EM6428/1 was of similar or slightly greater size than the industry standard cultivars Glen Ample and Tulameen

2005 comments

The berry size of many of the entries was smaller than the previous year. Octavia, Glen Ample (micro-propagated), 9062E-1 (Glen Fyne), EM6506/37, Tulameen (rooted cuttings) and 9053B6 (Glen Doll) produced fruit with average weights of >4.0 g. The fruit of EM6545/12 was again very small and that of EM6885/1, EM6390/47, EM6544/80 and 9046RA2 of similar size or on average smaller than that of Glen Moy.

2006 comments

Octavia and EM6506/37 again had the largest fruit, averaging >4.0 g in weight; Glen Ample (micro-propagated) also had similar size fruit. However average berry size of all entries was lower than the previous years due to the poor spring and summer weather and the affects of *Phytophthora* infection on plants. The average fruit size of 9059D-2, 9053B6 (Glen Doll), 9062E-1 (Glen Fyne) and EM6428/1 was >3.5 g and similar to or higher than that of Glen Ample (rooted cuttings) and Tulameen (rooted cuttings and micro-propagated), so could be considered to produce fruit of a commercially acceptable size consistently through their harvest period.

Berry quality at harvest

The mean scores for berry quality at harvest for the main entries are given in Tables 8, 9 and 10.

Table 8. Mean berry quality scores for main entries in 2004

Variety/selection	Redness	Brightness	Outline	Texture	Skin Strength	Berry Cohesion	Flavour
EM 6385/1 ®	3.2	4.5	4.3	2.9	3.4	4.7	3.6
EM 6390/47 ®	2.5	4.0	4.0	3.1	3.4	4.7	2.3
EM6428/1®	4.0	2.7	3.4	2.6	3.6	3.8	2.1
EM 6506/37 ®	2.2	3.2	4.5	3.3	4.1	4.9	2.9
EM 6512/50 ® (Octavia)	3.3	3.6	3.8	3.1	3.7	4.1	2.7
EM 6544/80 ® (Malling Juno)	3.0	3.6	4.3	3.8	3.9	4.8	3.5
EM 6545/12 ®	2.6	3.4	3.6	3.6	3.8	3.8	2.9
Glen Moy ®	3.9	2.9	3.3	2.8	2.9	4.0	3.1
Glen Ample®	3.0	4.1	3.5	3.3	3.8	3.4	3.3
Tulameen ®	3.0	4.5	3.5	2.9	3.6	4.0	4.0
9059D-2 (M)	3.1	4.1	2.9	3.6	3.9	3.7	2.8
9062E-1 (M) (Glen Fyne)	-	-	-	-	-	-	-
9050RD3 (M)	2.7	3.2	4.0	4.0	4.5	4.3	1.8
9046RA2 (M)	2.7	3.7	3.7	4.4	4.5	4.5	2.4
9053B6 (M) (Glen Doll)	2.9	4.3	4.0	3.9	4.2	4.5	3.4
Glen Ample (M)	-	-	-	-	-	-	-
Tulameen (M)	-	-	-	-	-	-	-
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. irregular 5 = even	1 = v. soft 5 = firm	1 = weak 5 = strong	1 = crumbly 5 = whole fruit	1 = v. poor 5 = v. good

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Table 9. Mean berry quality scores for main entries in 2005

Variety/selection	Redness	Brightness	Outline	Texture	Skin Strength	Berry Cohesion	Flavour
EM 6385/1 ®	3.0	5.0	4.4	2.6	3.6	4.4	3.2
EM 6390/47 ®	2.4	4.0	3.8	2.6	3.6	4.6	2.6
EM6428/1®	4.0	2.5	2.8	2.3	1.8	3.0	2.0
EM 6506/37 ®	2.5	3.3	4.3	3.3	4.2	4.8	3.2
EM 6512/50 ® (Octavia)	3.2	3.6	3.9	3.2	4.2	4.1	2.7
EM 6544/80 ® (Malling Juno)	2.6	3.8	3.8	3.2	3.8	5.0	3.8
EM 6545/12 ®	2.4	3.4	2.6	3.2	4.2	3.4	2.8
Glen Moy ®	4.2	3.5	3.5	3.0	3.7	4.2	3.7
Glen Ample®	3.0	4.5	3.7	3.7	4.0	3.5	3.5
Tulameen ®	2.9	4.4	3.2	3.2	3.8	3.8	4.2
9059D-2 (M)	3.5	3.8	3.0	3.8	4.2	4.2	3.5
9062E-1 (M) (Glen Fyne)	2.6	4.8	4.4	4.0	4.6	4.8	4.8
9050RD3 (M)	-	-	-	-	-	-	-
9046RA2 (M)	3.0	3.8	2.4	4.2	4.8	4.6	3.2
9053B6 (M) (Glen Doll)	3.0	4.7	4.5	4.0	4.7	4.7	4.3
Glen Ample (M)	3.0	4.3	3.8	3.7	3.8	4.0	3.7
Tulameen (M)	3.0	4.0	3.2	3.3	3.5	4.0	4.0
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. irregular 5 = even	1 = v. soft 5 = firm	1 = weak 5 = strong	1 = crumbly 5 = whole fruit	1 = v. poor 5 = v. good

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Table 10. Mean berry quality scores for main entries in 2006

Variety/selection	Redness	Brightness	Outline	Texture	Skin Strength	Berry Cohesion	Flavour
EM 6385/1 ®	3.0	5.0	5.0	3.0	3.3	5.0	2.7
EM 6390/47 ®	3.1	4.8	4.0	3.1	3.5	3.9	3.0
EM6428/1®	4.1	3.5	3.1	2.6	4.1	4.0	2.5
EM 6506/37 ®	2.5	4.0	5.0	3.0	3.5	5.0	3.5
EM 6512/50 ® (Octavia)	4.0	4.0	4.0	3.0	4.2	4.0	3.0
EM 6544/80 ® (Malling Juno)	3.0	4.3	4.8	3.8	3.8	4.8	4.3
EM 6545/12 ®	3.0	4.5	1.5	3.5	4.0	2.5	2.5
Glen Moy ®	4.0	4.0	3.3	3.0	3.3	4.0	4.0
Glen Ample®	3.0	5.0	3.3	3.5	4.3	3.5	4.3
Tulameen ®	3.0	4.8	3.0	3.0	3.5	3.5	4.8
9059D-2 (M)	3.2	4.7	3.1	3.4	4.0	3.8	3.4
9062E-1 (M) (Glen Fyne)	3.0	5.0	4.2	3.9	4.2	4.3	4.5
9050RD3 (M)	-	-	-	-	-	-	-
9046RA2 (M)	2.6	4.4	3.4	4.2	4.8	4.4	3.0
9053B6 (M) (Glen Doll)	3.0	5.0	4.0	3.9	4.4	4.0	4.1
Glen Ample (M)	3.0	4.9	4.0	3.4	4.1	4.0	4.0
Tulameen (M)	3.0	4.8	3.2	3.0	3.7	3.5	4.7
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. irregular 5 = even	1 = v. soft 5 = firm	1 = weak 5 = strong	1 = crumbly 5 = whole fruit	1 = v. poor 5 = v. good

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Comments on the primary fruit traits of the main entries observed during the three harvest seasons of the experiment are as follows:

EM 6385/1: round conic shaped mid red fruit are attractive in appearance, bright, glossy, cohesive uniform in shape, but deteriorate in size through harvest. Berries

have a very pronounced skin and soft texture drupes can rupture easily when fruit fully ripe. Berry flavour inconsistent from sweet to weak and insipid.

EM 6390/47: dark pink-red to very dark red berries when fully ripe, glossy/bright attractive appearance when under ripe but dulls as ripens, variable in shape from conic to blunt conical and wedge shaped. Large receptacle, small very evenly set drupelets, very cohesive, skin can be prominent. Texture very soft when fruit fully ripe and prone to collapse soon after harvest in hot weather, sweet but weak flavour.

EM6428/1: pale pink/red large round or conic shaped fruit have a bloom giving them a dull unattractive appearance, variable colour, subject to unevenness of set and on occasions to high level of crumble. Twin or split berries a problem at times, very soft texture when fully ripe. Very poor flavour and prominent skin make this selection unpleasant to eat.

EM 6506/37: very evenly set attractive, large blunt conical fruit, mid pink-red in colour but appear lighter due to gloss and some bloom on berry surface. Look very attractive on plant and in punnet, in part due to very even set and sized drupelets, plugs easily. Can become unacceptably dark, drupes easily ruptured when fully ripe. Texture soft, similar to Tulameen, often too soft when ripe, flavour generally good, sweet but not distinctive, occasionally insipid. Berries can be prone to damage by UV light.

EM 6512/50 (Octavia): round-conic to conic, very large fruits, generally evenly set, but with some crumble at beginning and end of harvest. Large receptacle but berry firm and does not readily collapse in on itself. Variable berry colour (blotchiness) on occasions and especially during first and last week of harvest. Berries pink red to mid red, generally glossy, darkening as they ripen. Flavour good to weak not unpleasant but lacks distinction.

EM 6544/80 (Malling Juno): mid red, bright, very evenly set, cohesive attractive blunt conic-conical shape. Texture fleshy, firm, softens as berries ripen. Very pleasant sweet, distinct flavour, berries look very attractive on plant and in punnet.

EM 6545/12: very dark red, very uneven shape, set round-conic shaped fruit. Prominent skin, moderate to very poor flavour, high percentage of fruit harvested unmarketable.

9059D-2: mid red round-conic shaped fruit, bright/glossy, large drupelets, very variable shape and often fruit poor set. High percentage of unmarketable fruit; darkens as ripens and texture varies. Noticeably firm up until 50% pick and thereafter when fully ripe can be unacceptably soft with drupelets prone to rupturing and bleeding. Flavour variable from sweet and pleasant to weak.

9062E-1 (Glen Fyne): mid- to dark red when fully ripe, round to conic in shape, large receptacle but fruit very evenly set and cohesive and not prone to collapsing in on itself. If picked under-ripe, occasionally some shearing of drupes around rim of fruit. Very bright berries look attractive on plant and in punnet, fleshy firm texture on a par with Glen Ample. 9062E-1 consistently was scored as having an excellent sweet aromatic, rich and distinct flavour.

9050RD3: mid to dark red, blunt conical fruit, glossy, very evenly set, but very small, very cohesive, firm, but very poor flavoured berries.

9046RA2: round to round-conic often very uneven in shape and set, pale to mid-red in colour, dark purple red when fully ripe. Variable drupelet and berry size, bright, some distinct bloom and berries dull in appearance as they ripen. Berries cohesive, texture firm to soft, easily bruised when fully ripe, seeds prominent. Flavour can be sweet moderately good but often weak and poor.

9053B6 (Glen Doll): deep mid red, very glossy attractive round to slightly conic shaped fruit. Very even drupelet size, very cohesive, texture firm, fleshy, softens when fully ripe. Berry flavour sweet and can be excellent when berries fully ripe. The appearance of this selections fruit on the plant and in the punnet was consistently very good.

Shelf life

The results of the shelf life assessments for the main entries in each of the three years are given in Tables 11, 12 and 13. Shelf life was generally acceptable in 2004 and

2005. However in 2006, exceptionally high daily temperatures in July and early August 2006 resulted in substantially reduced shelf life, with consequently lower scores for most of the main entries compared with the previous harvest seasons.

Table 11. Mean shelf-life scores for main entries in 2004

Variety/selection	Rotten Berries	Berry Texture	Appearance
EM 6385/1 ®	5.0	3.1	3.8
EM 6390/47 ®	5.0	2.4	2.8
EM6428/1®	5.0	2.5	2.5
EM 6506/37 ®	5.0	3.1	3.1
EM 6512/50 ® (Octavia)	5.0	3.3	3.6
EM 6544/80 ® (Malling Juno)	5.0	3.0	3.0
EM 6545/12 ®	5.0	2.4	2.4
Glen Moy ®	5.0	3.3	2.6
Glen Ample®	5.0	3.6	3.9
Tulameen ®	5.0	2.7	3.5
9059D-2 (M)	5.0	3.5	3.8
9062E-1 (M) (Glen Fyne)	-	-	-
9050RD3 (M)	5.0	3.3	3.5
9046RA2 (M)	5.0	3.2	3.3
9053B6 (M) (Glen Doll)	5.0	3.7	3.9
Glen Ample (M)	-	-	-
Tulameen (M)	-	-	-
	1 = 5 or more rotten fruit 5 = no rotten fruit	1 = collapsed 5 = as picked	1 = very dull 5 = very bright

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Table 12. Mean shelf-life scores for main entries in 2005

Variety/selection	Rotten Berries	Berry Texture	Appearance
EM 6385/1 ®	5.0	3.4	3.5
EM 6390/47 ®	5.0	2.7	2.6
EM6428/1®	5.0	2.8	2.6
EM 6506/37 ®	5.0	3.3	3.1
EM 6512/50 ® (Octavia)	4.9	3.4	3.5
EM 6544/80 ® (Malling Juno)	5.0	3.1	2.7
EM 6545/12 ®	5.0	1.7	1.7
Glen Moy ®	5.0	2.6	2.5
Glen Ample®	5.0	4.0	3.8
Tulameen ®	5.0	2.8	3.4
9059D-2 (M)	4.9	3.5	3.3
9062E-1 (M) (Glen Fyne)	5.0	3.3	3.6
9050RD3 (M)	-	-	-
9046RA2 (M)	4.9	3.4	3.1
9053B6 (M) (Glen Doll)	4.9	4.1	4.1
Glen Ample (M)	5.0	3.6	4.1
Tulameen (M)	4.9	3.2	3.3
	1 = 5 or more rotten fruit 5 = no rotten fruit	1 = collapsed 5 = as picked	1 = very dull 5 = very bright

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(M) Micropropagated plants

Table 13. Mean shelf-life scores for main entries in 2006

Variety/selection	Rotten Berries	Berry Texture	Appearance
EM 6385/1 ®	5.0	4.0	3.0
EM 6390/47 ®	5.0	2.0	1.8
EM6428/1®	5.0	2.0	2.3
EM 6506/37 ®	5.0	3.0	4.0
EM 6512/50 ® (Octavia)	5.0	3.3	3.3
EM 6544/80 ® (Malling Juno)	5.0	3.7	4.0
EM 6545/12 ®	5.0	2.0	2.0
Glen Moy ®	5.0	2.0	2.0
Glen Ample®	5.0	3.7	3.3
Tulameen ®	5.0	3.0	3.0
9059D-2 (M)	5.0	3.5	3.3
9062E-1 (M) (Glen Fyne)	5.0	4.3	4.5
9050RD3 (M)	-	-	-
9046RA2 (M)	5.0	3.4	2.8
9053B6 (M) (Glen Doll)	5.0	4.0	4.5
Glen Ample (M)	5.0	3.2	4.0
Tulameen (M)	5.0	2.8	3.8
	1 = 5 or more rotten fruit 5 = no rotten fruit	1 = collapsed 5 = as picked	1 = very dull 5 = very bright

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(M) Micropropagated plant

9053B6 (Glen Doll) and 9062E-1 (Glen Fyne) had fruit with a superior shelf life in all of their cropping seasons. Texture and appearance post cold storage were better than that of the industry standards Glen Ample and most particularly Tulameen.

EM6544/80 (Malling Juno) produced fruit of marketable condition throughout the life of the experiment (unlike Glen Moy). The texture of its fruit was however by this stage far softer than either 9053B6 (Glen Doll), 9062E-1 (Glen Fyne) or Glen Ample. With the exception of EM6506/37 all other entries produced fruit that was at times

(consistently so in the case of EM 6545/12, EM6428/1, EM 6390/47) unmarketable post cold storage.

Market acceptability

Appraisal by supermarket technologists: the results of the appraisals done by technologists from supermarkets in 2005 are given in Tables 14 (Sainsburys), 15 (Marks & Spencer), 16 (Tesco) and 17 (Waitrose).

Table 14. Assessments of fruit characteristics by Sainsburys technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 14 July 2005				
Tulameen	3	4	4	Sample typical of variety
Glen Ample	3	4	4	Sample typical of variety
EM6544/80 (Malling Juno)	3	3	2	Sweet, dense but soft texture
EM 6390/47	2	1	2	Bitter no flavour/sugar
b) 22 July 2005				
Tulameen	4	5	4	Sample typical of variety
Glen Ample	4	5	4	Sample typical of variety
Octavia	4	3	4	Variable flavour, sweetness but slightly bitter
Glen Doll	4	4	5	Slightly unripe, very firm
EM 6505/37	2	3	3	Uneven colour. Easily bruises. Good flavour
Glen Fyne	4	5	4	Interested in this cultivar
c) 5 August 2005				
Tulameen	1	1	1	Very soft bleeding poor
Glen Ample	4	3	2.5	Slight sweetness
Octavia	3	1	4	Bland flavour, lacks sugar
Glen Doll	2	1	2	Soft over ripe
Glen Fyne	3	3	2	Slightly over ripe and softening
	1 = poor 5 = excellent	1 = poor 5 = excellent	1 = very soft 5 = firm	

Table 15. Assessments of fruit characteristics by Marks & Spencer technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 12 July 2005				
Tulameen	4.5	4	3	Best appearance/ eating quality
Glen Ample	3.5	3	3	-
EM6544/80 (Malling Juno)	2.5	2	3	Berries small
EM 6390/47	3	2	3	-
b) 4 August 2005				
Tulameen	4	4	3	Good but have tasted better fruit of this cultivar
Glen Ample	3	3	3	-
Octavia	4	3	3	-
Glen Doll	4	3.5	3	-
Glen Fyne	4	4	3	Best eating cultivar
EM 6505/37	2	3.5	3	Pale appearance but sweet
	1 = poor 5 = excellent	1 = poor 5 = excellent	1 = very soft 5 = firm	

Table 16. Assessments of fruit characteristics by Tesco technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 2 August 2005				
Tulameen	3.4	4.5	5	V good flavour
Glen Ample	4	4	4	Uniform sample
Octavia	4	3.5	5	-
Glen Doll	4	4	4	Uniform appearance & flavour
	1 = poor 5 = excellent	1 = poor 5 = excellent	1 = very soft 5 = firm	

Table 17. Assessments of fruit characteristics by Waitrose technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 1 August 2005				
Tulameen	3	5	4	Poor appearance, uneven shape & colour
Glen Ample	4	1	4	Not sweet
Octavia	3	2	4	Poor flavour
Glen Doll	4	4	5	Good overall & flavour
EM 6505/37	3	2	2	Dull appearance, irregular set
	1 = poor 5 = excellent	1 = poor 5 = excellent	1 = very soft 5 = firm	

Appraisal by farm shop customers: the results of the appraisals done by customers at Rectory Farm Shop in July 2005 are given in Table 18.

Table 18. Average scores (out of 100) for samples of fruit assessed by retail customers

Date Variety/ Selection	Do you like the fruits appearance?		Do you like the fruits texture?		Do you like the fruits flavour?		Would you purchase this variety/selection?	
	Yes	No	Yes	No	Yes	No	Yes	No
a) 8 July 2005								
Glen Ample	94	6	89	11	67	33	70	30
EM 6544/80 (Malling Juno)	80	20	64	36	65	35	52	48
b) 9 July 2005								
Glen Moy	83	17	81	19	40	60	38	62
Tulameen	100	-	94	6	94	6	91	9
Glen Fyne	95	5	82	18	77	23	77	23

c) 10 July 2005								
Glen Ample	100	-	94	6	85	15	83	17
9046RA2	80	20	49	51	20	80	15	85
9059D-2	71	29	63	37	41	59	35	65
Glen Doll	94	6	88	22	69	31	67	33
EM 6390/47	78	22	75	25	42	58	44	56
EM 6385/1	93	7	80	20	68	32	69	31

Sensory appraisal

Samples of fruit harvested from the SCRI trial entries and samples of fruit of Glen Ample and Tulameen also harvested from the trial were submitted to Charis Food from Thought on 17 July 2005 (two punnets of each cultivar) and Sensory Scotland Ltd on the 18 July 2006. These samples were subjected to a full sensory appraisal by a professional panel. The following characteristics were evaluated using an attribute rating of 1-100 for each characteristic, where 1 = the lowest (worst) score and 100 = the highest (best) score.

- Appearance (colour, uniformity of appearance and berry size)
- Flavour (fruitiness, sweetness, woodiness, acid/sourness balance, raspberry, grassy, bitter, floral)
- Aftertaste (intensity, persistence)
- Mouthfeel (firmness, seediness, juiciness)
- Overall acceptability

The results for the 2005 the assessments done by Charis Food from Thought are given in Tables 19 to 21.

Table 19. Fruit appearance (rating 1-100) as assessed by Charis Food for Thought, July 2005.

Genotype	Red	Brown	Purple	Uniform	Size
9059D-2	61.1	0.0	4.1	62.2	48.9
9046RA-2	59.3	1.1	14.3	56.8	45.9
Glen Fyne	63.2	0.1	18.9	70.3	57.5

Glen Doll	64.9	0.3	11.4	62.4	56.8
Glen Ample	58.4	0.1	8.0	62.4	54.8
Tulameen	61.5	0.4	10.5	56.2	55.5

Comments were as follows:

Redness: Glen Doll and Glen Fyne followed by Tulameen and 9059D-2 were judged to be the most red.

Brown: all selections/cultivars had a very low score with 9046RA-2 being the highest for this trait.

Purple: Glen Fyne followed by 9046RA-2 were judged to be the most purple and 9059D-2 the least purple in their colour

Uniformity: the berries of Glen Fyne, Glen Doll and Glen Ample were judged to be the most uniform in colour. The least uniform were those of Tulameen and 9046RA-2.

Berry size: the fruit submitted for appraisal was most uniform for Glen Fyne and Glen Doll. 9046RA-2 and 9059D-2 were the least uniform.

Table 20. Fruit flavour (rating 1-100) as assessed by Charis Food for Thought, July 2005.

Genotype	Fruity	Sweet	Woody	Acid/Sour	Raspberry	Grassy	Bitter	Floral
9059D-2	48.8	19.8	7.3	48.7	44.6	8.8	6.5	10.8
9046RA-2	48.6	18.0	5.5	52.4	43.1	8.2	8.8	9.7
Glen Fyne	61.5	38.8	5.7	26.4	57.1	5.9	4.0	26.5
Glen Doll	54.3	20	8.3	49	51.7	2.5	10.5	14.9
Glen Ample	56.9	22.2	5.3	40.6	53.6	5.1	6.7	14.8
Tulameen	56.8	27.0	8.0	38.6	52.3	10.0	4.6	18.1

Comments were as follows:

Fruity: Glen Fyne followed by Glen Ample and Tulameen were judged to have the most fruity flavour, 9059D-2 and 9046RA-2 the least.

Sweet: the fruit of Glen Fyne was judged to be by far the sweetest of the samples submitted. Glen Ample, Tulameen and Glen Doll were judged to be sweet. 9059D-2 and 9046RA-2 had the lowest scores for sweetness

Woody: Glen Doll and Tulameen had the highest levels for woodiness detected in the berry flavour. Glen Ample had the lowest scores.

Acid/sour: 9046RA-2 had the highest acid/sour flavour and Glen Fyne the lowest score.

Raspberry: Glen Fyne and Glen Ample had the highest scores. 9059D-2 and 9046RA-2 the lowest score.

Grassy: Tulameen and 9059D-2 had the highest score; Glen Doll had the lowest score.

Bitter: Glen Doll had the highest bitter score; Glen Fyne and Tulameen had the lowest score.

Floral: Glen Fyne had an exceptional high score, followed by Tulameen, Glen Doll and Glen Ample. 9046RA-2 had the lowest scores.

Table 21. After taste, mouth-feel and acceptability rating (1-100) as assessed by Charis Food for Thought, July 2005.

Genotype	After taste		Mouth feel			
	Intensity	Persistence	Firmness	Seedy	Juicy	Acceptability
9059D-2	37.3	32.9	63.7	40.9	30.8	42.3
9046RA-2	36.4	31.5	54.1	42	35.4	37.3
Glen Fyne	33.9	30.2	46.6	34.1	43.5	62.6
Glen Doll	42.2	36.4	47.8	37.1	42.3	47.4
Glen Ample	39.1	36.3	53.5	38.4	35	50.6
Tulameen	37.5	32.3	53.1	40.2	40.1	55.0

Comments were as follows:

Intensity: Glen Doll had the most and Glen Fyne the least intensity of after-taste.

Persistence: Glen Doll & Glen Ample had the most and Glen Fyne the least persistent after- taste.

Firmness: 9059D-2 was judged very firm in the mouth, Glen Fyne, Glen Doll, Tulameen and Glen Ample soft. The latter were judged firmer than Glen Doll or Glen Fyne.

Seedy: 9046RA-2, Tulameen and 9059D-2 had the most noticeable seeds and the least Glen Fyne and Glen Fyne.

Juicy: Glen Fyne and Doll were the most and 9059D-2 the least juicy berries

Acceptability: Glen Fyne attained an exceptionally high score, which was in excess of that of Tulameen. The scores for Glen Doll were slightly less than that for Glen Ample. The lowest scoring entry was 9046RA-2

The results for the 2006 the assessments done by Sensory Scotland Ltd are given in Tables 22 to 24.

Table 22. Fruit appearance (rating 1-100) as assessed by Sensory Scotland Ltd, July 2006

Genotype	Red	Brown	Purple	Uniform	Size
9059D-2	63.4	-0.1	21.9	56.7	44.6
Glen Fyne	62.5	1.3	33.8	56.3	40.6

Glen Doll	58.6	0.3	27.4	63.7	47.5
Glen Ample	61.8	0.3	27.5	61.6	46.2
Tulameen	70.5	0.4	18.3	62.8	55.9

Comments were as follows:

Redness: Tulameen had the most intense red colour followed in order by 9059D-2, Glen Fyne, Glen Ample and Glen Doll.

Brown: Glen Fyne was judged to have the highest amount of brown in its colour.

Purple: the fruit of Tulameen and 9059D-2 were scored as least purple; Glen Fyne the most purple in colour.

Uniform: Glen Doll, Tulameen and Glen Ample were found to be the most and Glen Fyne the least uniform (i.e. the most complex) in colour.

Berry size: the fruit of Tulameen were the most uniform in size of Glen Fyne were the least uniform in size.

Table 23. Fruit flavour (rating 1-100) as assessed by Sensory Scotland Ltd, July 2006

Genotype	Fruity	Sweet	Woody	Acid/Sour	Raspberry	Grassy	Bitter	Floral
9059D-2	51.7	34.1	9.3	31.3	44.2	7.4	8.8	12.2
Glen Fyne	43.6	27.9	16.1	27.4	36.0	10.8	8.2	7.4
Glen Doll	47.8	26.9	11.2	44.6	42.4	9.5	8.0	10.5
Glen Ample	52.8	28.3	8	35.2	44.4	9.6	4.2	16.0
Tulameen	52.8	28.8	8.5	37.8	42.4	11.6	7.7	12.9

Comments were as follows:

Fruity – Glen Ample and Tulameen were judged to have the most and Glen Fyne the least fruity flavour.

Sweet: 9059D-2 and Glen Ample had the sweetest flavour.

Woody: Glen Ample and Tulameen had the least and Glen Fyne and Glen Doll the highest levels of woodiness detected in the berry flavour.

Acid/Sour: Glen Doll and Glen Ample had the highest acid/sour flavour; Glen Fyne and 9059-D2 had the lowest scores for this trait.

Raspberry: the fruit of all the selections/varieties tested had a distinct raspberry flavour. Glen Ample and 9059D-2 scored highest; Glen Fyne had a particularly low score.

Grassy: 9059D-2 scored particularly low for this trait.

Bitter: most of the selections had similar scores with the exception of Glen Ample which achieved a low score.

Floral: Glen Ample scored highest, and Glen Fyne the lowest, for floral smell/taste.

Table 24. After taste, mouth-feel and acceptability rating (1-100) as assessed by Sensory Scotland Ltd, July 2006

Genotype	After taste		Mouth feel			
	Intensity	Persistence	Firmness	Seedy	Juicy	Acceptability
9059D-2	35.2	29.4	30.0	29.3	41.2	44.1
Glen Fyne	35.7	29.5	16.5	25.7	46.8	34.9
Glen Doll	38.4	36.8	27.8	25.8	44.6	34.4
Glen Ample	36.5	32.1	41.7	27.3	33.9	48.4
Tulameen	39.3	36.3	28.6	27.4	49.7	42.4

Comments were as follows:

Intensity: the flavour of the fruit of Tulameen and Glen Doll scored highest; the lowest scoring selection was 9059D-2.

Persistence: Tulameen and Glen Doll had the most persistent and Glen Fyne and 9059D-2 the least persistent after-taste.

Firmness: Glen Ample had the firmest and Glen Fyne the softest fruit in the mouth. The firmness scores for Tulameen and Glen Doll were very similar.

Seedy: Glen Doll & Fyne scored lowest for seediness.

Juicy: Tulameen, Glen Fyne and Glen Doll had the most and Glen Ample the least juicy fruit.

Acceptability: Glen Ample had the highest level of acceptability followed by 9059D-2. Glen Fyne and Glen Doll were the least acceptable.

Grower assessment at Open Days

The results of the grower assessments done at the HDC Open Days on 6 July 2004 and 14 July 2006 are given in Tables 25 and 26.

Table 25. Average scores for the main entries assessed at HDC Open Day on 6 July 2004

Variety/Selection	Redness	Brightness	Texture	Flavour	Commercial potential
EM6385/1	2.6	4.3	2.8	4	Yes
EM6390/47	2.8	3.1	1.9	2.7	Possibly
EM6428/1	3.4	2.4	2.7	2.4	No
EM6506/37	3.3	3.9	3.8	3.1	Yes
EM 6512/50 (Octavia)	3.5	3.2	3.3	3.7	Yes
EM6544/80 (Malling Juno)	3.1	3.1	3	3	Yes
EM6545/12	3.4	2.6	3.4	2.5	No
Glen Moy	3	2.9	2.7	3.1	No
Glen Ample	3.3	3.9	2.8	3.9	No
Tulameen	3.2	3.9	3.4	4.1	Yes
9059D-2	3	2.7	3.7	2.8	No
9062E-1 (Glen Fyne)	-	-	-	-	-
9050RD3	2.7	2.1	2.8	1.6	No
9046RA2	2.7	2.6	3.9	1.6	No
9053B6 (Glen Doll)	3.1	2.1	3.6	2.8	Possibly
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. soft 5 = firm	1 = v. poor 5 = v. good	

Table 26. Average scores for the main entries assessed at HDC Open Day on 14 July 2006

Variety/Selection	Redness	Brightness	Texture	Flavour	Commercial potential
EM6506/37	3	2.5	3.5	3	No
Glen Ample	3.5	3	3	3	Yes
Tulameen	3.5	3.5	2.5	4	Yes

9059D-2	3	3.5	3	2.5	No
9062E-1 (Glen Fyne)	2.7	3.5	3.5	4	Yes
9053B6 (Glen Doll)	3.5	4	4	3.5	Yes
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. soft 5 = firm	1 = v. poor 5 = v. good	

Plant characteristics of main entries

The plant characteristics of the main entries are described below. The fruit characteristics for these varieties are given in Table 27.

EM6385/1: canes can be very tall, adequate in number but noticeable variability in height, upright in habit, very spiny and unpleasant to handle. Bud break at same time as Glen Ample, leaves fall early in autumn.

Very long fruit laterals, prone to breakage and bow over during harvest, hampering picking.

EM6390/47: canes variable but most of moderate, adequate number, upright to spreading habit. Primocane more or less spine-free, pleasant to handle but requires support during harvest or obscures fruit laterals and hampers picking. Bud break very early, at same time as Glen Moy so very susceptible to injury by late winter/early spring frosts. Very even bud break down whole length of floricane. Retains leaves late into autumn.

Fruit laterals variable in length but most very long, prone to kinking at their base and breakage at their tips. Bow over and hamper picking.

EM6428/1: primocane spine-free, upright to spreading in habit, produced in adequate numbers, tall, pleasant to handle. Leaves retained late into autumn, some flower/fruit production on tips of primocane in the autumn. Bud break of floricane in spring at same time as that of Glen Ample.

Fruit lateral length variable according to position on floricane, from very short at tip to long or very long at their base. Very leafy, brittle at tip and readily broken, but present fruit in the main well to pickers, fruit rather exposed to weather.

EM6506/37: primocane more or less spine-free, upright to slightly spreading in habit, very tall or of medium height and vigour, adequate in number, pleasant to handle, need support during harvest or will hamper picking.
Very long drooping fruit laterals, strongly attached to floricane, but with tendency to break at tip, leaves roll over each other during harvest hampering picking.

EM 6512/5 (Octavia): young primocane, bear very prominent spines, handling at this stage unpleasant, very numerous, leafy, tall with a distinct upright habit. Primocane vigour and height can noticeably decline as plants age. Bud break early but, unlike those of other cultivars, fail to grow away rapidly thereafter; they can be prone to frost damage.
Fruit laterals very long, strongly attached to floricane, leafy, slightly drooping at their tip but display fruit well to picker.

EM6544/80 (Malling Juno): primocane spine-free, pleasant to handle, upright to very slightly spreading at their top, produced in adequate numbers, medium or tall in height. Very early bud break so potentially very susceptible to damage by frost. Very even bud break from tip to base of floricane, even after an exceptionally mild winter. Leaves retained late into the autumn, with in some years flower/fruit production on tips of primocane. However this tendency is far less pronounced than with Glen Moy.
Fruit laterals vary in length and pose according to their position on the floricane, from long and held horizontal at their base to very short and strongly ascending at their tip. The laterals are strongly attached, leafy present fruit very well to picker.

EM6545/12: primocane more or less spine-free, upright to spreading at their tip, tall or very tall, present in adequate numbers. Retain leaf well into the autumn. Bud break very early and even down length of floricane, susceptible to cold injury.
Fruit laterals very long at base of and of medium length at tip of floricane. Strongly attached, horizontal or slightly ascending habit, tendency to be broken at their tip but otherwise present fruit well to picker.

Glen Moy: primocane spine-free, upright in habit, very leafy, adequate number, tall to medium in height, pleasant to handle. Retain leaves well into autumn and produce flowers/fruit readily at their tips.

Fruit laterals very leafy short or only of medium length, ascending to horizontal in habit, readily broken during harvest, present fruit reasonably well to pickers.

Glen Ample: primocane tall to very tall, numerous, upright to spreading and very leafy, can be difficult to handle, need support during harvest or readily obscure fruit from pickers. Very variable bud break down length of cane.
Fruit laterals very long leafy, strongly attached, held just below horizontal, drooping at tip, tips can be broken during harvest, but present fruit reasonably well to picker. Fruit detachment is easy.
No noticeable difference between plants propagated from root cuttings or from micro propagation.

Tulameen: canes tall to very tall, adequate to sparse in number, upright to spreading, some spines, can be difficult to handle, require support during harvest or hamper picking. Early and even bud break down length of floricane.
Fruit laterals very long, leafy, strongly attached, held horizontal, but can break at tip during harvest. Display fruit reasonably well to pickers. Fruit detachment is easy when the fruit is ripe.
No noticeable difference between plants propagated from root cuttings or from micro propagation.

9059D-2: spine-free primocane, upright to spreading, very variable in height, adequate number. Pleasant and easy primocane to handle, leaves retained late into the autumn with some flower/fruit production on the primocane tips. Even bud break down length of floricane in spring at about the same time as that of Glen Ample.
Fruit laterals very long and drooping in habit at base and of medium length and held horizontal from middle to tip of floricane. Strongly attached but readily break at their tip, leafy but present fruit very well to picker.

9050RD3: spine-free, very spreading, primocane difficult to manage especially during harvest, when it obscures fruit from pickers and hampered picking. Very variable cane height and number. Generally cane very difficult to manage and train pre-, during and post-harvest. Foliage retained until late into the autumn, fruit

production on tips of primocane. Bud break early and even down whole length of canes.

Fruit laterals very long and drooping in habit at base and of medium length and held horizontal from middle to tip of floricane. Very brittle at base and readily broken by pickers or by wet windy weather during harvest, fruit picking hampered by presence of large number of collapsed laterals.

9046RA2: primocane more or less spine-free, upright to spreading in habit, adequate number but very variable in height. Pleasant to handle foliage retained late into autumn. Bud break at same time as that of Glen Ample but far more even down length of cane.

Fruit laterals vary in length according to position on floricane but in general are long to very long at the floricane base. Bow over at their tip but generally present fruit well to pickers although fruit detachment at times was difficult with this entry.

9053B6 (Glen Doll): very late bud break of floricane and then evenly down more or less the length of all cane. Primocane tall to very tall, stout, upright, vigorous adequate in number, spine free and very pleasant and easy to manage. Permit fruit to be well displayed at harvest. Leaves retained late into autumn.

Fruit laterals very long strongly attached, held horizontal to markedly ascending, present fruit very well to pickers, occasionally some breakage at their tip. Fruit detachment is very easy.

9062E-1 (Glen Fyne): primocane, spine-free medium in height, upright to spreading in habit and produced in adequate numbers. Easy and pleasant to handle, bud break is very early and even down the length of cane. Foliage retained late into autumn.

Fruit laterals long at the base to short at the top of floricane. Strongly attached, all are held horizontal to slightly ascending, displaying fruit well to pickers. Fruit detachment is very easy.

Table 27. Fruit characteristics of main entries

Variety/Selection	Shape & size	Colour & brightness	Cohesiveness	Texture	Flavour
EM6385/1	Round-blunt conic very even & consistent set; small fruit	Mid red, very bright attractive; some bloom	Very cohesive	Soft	Good; sweet
EM6390/47	Conic-wedge shaped some variation in shape; small fruit	Mid-dark red bright	Very cohesive	Fairly firm	Weak-poor
EM6428/1	Round-round conic; very variable shape & drupelet size, ugly in appearance; large fruit	Pale pink/red-salmon pink, dull	Reasonably cohesive, top of fruits can tear	Very soft, easily damaged	Poor, insipid
EM6506/37	Blunt long conical; very consistent & even set; large fruit	Dark pink red bright	Very cohesive	Firm; berry surface easily bruised	Moderate
EM 6512/50 (Octavia)	Round-round conic; evenly set large drupes; large fruit	Pale-mid red; some variability in drupe colour at start & end of harvest	Cohesive top of fruits occasionally can tear	Firm	Moderate-good
EM6544/80 (Malling Juno)	Blunt conic consistent even set; small fruit	Mid-red, bright	Very cohesive	Firm	Sweet, excellent flavour
EM6545/12	Very variable shape & size mainly blunt conical; small fruit	Pale-mid red, some brightness but bloom on surface	Moderately cohesive, high % of crumble	Very soft	Very poor, insipid
Glen Moy	Conic-blunt conical some variation in drupelet size & shape; small fruit	Pale red; a little dull	Good except towards the end of harvest	Soft; easily bruised	Good, sweet
Glen Ample®	Round-conic; even set, large fruit	Mid-red, very bright	Good except towards the end of harvest	Very firm	Good, sweet
Tulameen ®	Conical; variable set, irregularly set fruit; large fruit	Mid-red, very bright	Reasonably good	Moderate-soft	Excellent, very sweet
9059D-2	Blunt conical; very uneven set, drupelet & berry size; large fruit	Pale-mid red, very bright	Very cohesive	Firm	Moderate
9062E-1 (Glen Fyne)	Conic; even set & shape; large fruit	Mid-dark red; bright	Very cohesive	Firm	Excellent, very sweet
9050RD3	Blunt conical, evenly set; small fruit	Mid-dark red; bright	Very cohesive	Very firm	Very poor
9046RA2	Blunt conical small fruit	mid red; bright but some bloom on berry	Very cohesive; tendency for top of	Very firm	Moderate-poor, distinct dry

		surface	berries to tear		texture
9053B6 (Glen Doll)	Round-conic; consistent shape & set; large fruit	Mid-dark red; very bright	Very cohesive	Very firm	Good, sweet flavour

Susceptibility of main entries to pest and disease

The pest and disease symptoms evident on the main entries throughout the life of the trial are described below.

EM6385/1: moderately susceptible to cane botrytis and spur blight. Susceptible to *Phytophthora rubi.*

EM6390/47: susceptible to *Phytophthora rubi*, rind of primocane splits readily during summer months, no spur blight or cane botrytis infection observed. Susceptible to crown gall.

EM6428/1: slightly susceptible to spur blight and cane botrytis, susceptible to *Phytophthora rubi.*

EM6506/37: slightly susceptible to spur blight and cane botrytis, susceptible to *Phytophthora rubi.*

EM 6512/5 (Octavia): slightly susceptible to spur blight and cane botrytis, susceptible to *Phytophthora rubi*, foliage in late summer susceptible to raspberry rust.

EM6544/80 (Malling Juno): susceptible to *Phytophthora rubi*, foliage in late summer slightly susceptible to rust. Rind of primocane splits at cane base in late summer.

EM6545/12: susceptible to *Phytophthora rubi*, slightly susceptible to spur blight and cane botrytis, foliage in late summer slightly susceptible to raspberry rust. Rind of primocane splits readily at cane base in late summer.

Glen Moy: susceptible to *Phytophthora rubi*, rind of primocane splits freely during the summer months. Foliage in late summer very susceptible to raspberry rust.

Glen Ample: susceptible to infection by aphid borne virus, *Phytophthora rubi*, cane botrytis, spur blight and cane blight. Post harvest, foliage of primocane very susceptible to raspberry rust.

Tulameen: susceptible to *Phytophthora rubi*, cane *botrytis*, spur blight and cane blight. Post harvest, foliage of primocane very susceptible to raspberry rust.

9059D-2: susceptible to *Phytophthora rubi*, moderately susceptible to spur blight and cane botrytis. Rind of primocane splits at cane base in late summer.

9050RD3: susceptible to *Phytophthora rubi.* Rind of primocane splits readily at cane base during summer.

9046RA2 : susceptible to *Phytophthora rubi.* Rind of primocane splits readily at cane base during summer.

9053B6 (Glen Doll): susceptible to *Phytophthora rubi.* Primo- and floricane free of botrytis and spur blight. Low level of foliage infection by raspberry rust in the late summer/early autumn.

9062E-1 (Glen Fyne): low level of foliage infection by raspberry rust in the late summer/early autumn. Susceptible to *Phytophthora rubi.* Primo- and floricane free of botrytis and spur blight.

Guard entries

Yield

The yield obtained from the guard entries in each of the three harvest years (2004, 2005 and 2006) are given in Tables 28, 29 and 30 respectively. As with the main entries, dates of harvest and yield in each year reflected the prevailing weather conditions during the winter, spring and summer prior to harvest (see comments under yields for main entries for specific conditions in each of the three years).

Table 28. Harvest period and average yield (kg/plant) per plant of guard entries in 2004

Variety/ Selection	Harvest date				Yield (kg/plant)
	1st pick	50% pick	75% pick	Last pick	
**Rubaca®	28 June	20 July	27 July	06 August	0.56
Coho®	30 June	22 July	29 July	15 August	0.56
Wei-Rula ®	05 July	01 August	10 August	15 August	2.27
**Cowichan®	25 June	17 July	27 July	12 August	0.60
Kitsilano ®	02 July	25 July	04 August	15 August	3.17
**BC 90-8-20	28 June	17 July	27 July	06 August	0.45
**BC 90-8-11 ®	30 June	22 July	29 July	15 August	0.44
**BC 89-34-41® (Saanich)	02 July	26 July	01 August	12 August	0.90
**BC 89-2-89® (Esquimalt)	25 June	25 July	06 August	15 August	0.99
BC 89-33-84® (Chemainus)	25 June	17 July	25 July	10 August	2.41
EM 6413/59 ®	18 June	30 June	05 July	06 August	2.61
EM 6166/98® (Malling Minerva)	21 June	12 July	20 July	10 August	2.59
EM 5928/114® (Malling Hestia)	28 June	22 July	29 July	12 August	1.85
**EM 6495/53®	-	-	-	-	-
EM 6507/35®	28 June	14 July	22 July	10 August	1.82
EM 6487/74®	28 June	20 July	27 July	12 August	3.14
*9751E-2 (M)	-	-	-	-	-
*9612F-2 (M)	-	-	-	-	-
*00123A7 (M)	-	-	-	-	-
*9455E-3 (M)	-	-	-	-	-
*9451D-4 (M)	-	-	-	-	-

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

In 2004 (Table 28), EM 6413/59 had the earliest harvest and Wei-Rula the latest harvest of the guard entries in the trial with first fruit being picked respectively on the 18 June and 5 July. Kitsilano and BC 89-34-41 (Saanich) were also late to start harvest (2 July). BC 89-2-89 (Esquimalt) and EM 6166/98 (Malling Minerva) had the longest harvest period, while Rubaca and BC 90-8-20 had shortest harvest periods.

The 50% and 75% pick of EM 6413/59 was reached in 12 and 17 days and although fruit continued to be harvested from this selection until the 6 August the amounts of fruit harvested at each pick after the 5 July were very small. The 50% pick of EM 6507/35 was reached 16 days after the start of its harvest. But thereafter the harvest was very protracted with 75% pick being reached on the 22 July and last fruit picked on the 10 August. The harvest of BC 90-8-20 was the most compact of all the PARC entries with only 19 and 10 days between the first fruit being picked and 50% and 75% pick. In contrast it was 30 and 27 days between the onset of harvest and 50% pick for respectively BC 89-2-89 (Esquimalt) and Wei-Rula. All other guard entries took between 21 and 24 days to reach 50% pick.

The highest yield produced by the entries planted in June 2002 were Kitsilano and EM 6487/74 and the lowest by EM 5928/114 (Malling Hestia) and EM 6507/35. Of the entries planted in July 2003 Cowichan, Coho and Rubaca produced the most fruit.

In 2005 (Table 29), EM6413/59 was the first (22 June) and Wei-Rula (12 July) the latest entry in the trial to commence harvest. The 50% and 75% pick of BC 90-8-20 was reached in 17 and 7 days, BC 89-33-84 (Chemainus) and 9612F-2 in 18 and 9 days respectively. Due to a period of higher temperatures during late July, the period between 50 and 75% pick was 7-10 days for most entries. In the case of EM 6495/53 it was only 4 days and for EM 5928/114 and Wei-Rula it was only 5 days. This period was longest (12 days) for the SCRI selection 9451D-4, which was in its first cropping year.

Of the full cropping entries (those planted in June 2002 and 2003) Cowichan, EM 6413/59 and Coho produced the highest and BC 89-33-84 (Chemainus) the lowest

yield. Of the SCRI selections planted in July 2004, 9612F-2 produced the highest and 9451D-4 the lowest yield, but in both cases from very small plants.

Table 29. Harvest period and average yield (kg/plant) per plant of guard entries in 2005

Variety/ Selection	Harvest date				Yield (kg/plant)
	1st pick	50% pick	75% pick	Last pick	
**Rubaca®	1 July	21 July	28 July	14 August	2.16
Coho®	6 July	26 July	2 August	14 August	2.57
Wei-Rula ®	12 July	2 August	7 August	18 August	1.53
**Cowichan®	27 June	20 July	28 July	14 August	2.70
Kitsilano ®	4 July	28 July	4 August	11 August	1.60
**BC 90-8-20	4 July	21 July	28 July	14 August	2.20
**BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot				
**BC 89-34-41® (Saanich)	1 July	26 July	2 August	18 July	2.40
**BC 89-2-89® (Esquimalt)	4 July	26 July	2 August	14 August	0.82
BC 89-33-84® (Chemainus)	29 June	17 July	26 July	9 August	0.40
EM 6413/59 ®	22 June	6 July	14 July	11 August	2.73
EM 6166/98® (Malling Minerva)	29 June	19 July	26 July	11 August	1.13
EM 5928/114® (Malling Hestia)	4 July	28 July	2 August	11 August	1.61
**EM 6495/53®	4 July	26 July	30 July	11 August	1.61
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot				
EM 6487/74®	4 July	30 July	7 August	18 August	2.50
*9751E-2 (M)	27 June	23 July	2 August	11 August	0.39
*9612F-2 (M)	29 June	17 July	26 July	18 August	0.65
*00123A7 (M)	1 July	26 July	4 August	18 August	0.63
*9455E-3 (M)	29 June	23 July	2 August	18 August	0.64
*9451D-4 (M)	1 July	26 July	7 August	18 August	0.47

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

Table 30. Harvest period and average yield (kg/plant) per plant of guard entries in 2006

	Harvest date				
Variety/ Selection	**1st pick**	**50% pick**	**75% pick**	**Last pick**	**Yield (kg/plant)**
**Rubaca®	2 July	23 July	27 July	7 August	1.95
Coho®	3 July	23 July	27 July	7 August	2.16
Wei-Rula ®	3 July	27 July	31 July	7 August	1.06
**Cowichan®	30 June	17 July	23 July	7 August	2.47
Kitsilano ®	2 July	25 July	31 July	7 August	0.87***
**BC 90-8-20	2 July	21 July	23 July	7 August	2.75
**BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot				
**BC 89-34-41® (Saanich)	30 June	21 July	25 July	7 August	2.4
**BC 89-2-89® (Esquimalt)	Not harvested plants killed by *Phytophthora* root rot				
BC 89-33-84® (Chemainus)	Not harvested plants killed by *Phytophthora* root rot				
EM 6413/59 ®	26 June	30 June	3 July	17 July	1.66
EM 6166/98® (Malling Minerva)	Not harvested plants killed by *Phytophthora* root rot				
EM 5928/114® (Malling Hestia)	5 July	25 July	29 July	7 August	1.61
**EM 6495/53®	Not harvested plants killed by *Phytophthora* root rot				
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot				
EM 6487/74®	7 July	27 July	31 July	7 August	1.69
*9751E-2 (M)	26 June	17 July	23 July	7 August	0.99
*9612F-2 (M)	28 June	15 July	21 July	7 August	2.65
*00123A7 (M)	26 June	15 July	21 July	2 August	3.16
*9455E-3 (M)	2 July	15 July	23 July	31 July	1.18

*9451D-4 (M)	2 July	23 July	29 July	7 August	1.61

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

In 2006, by May the majority of the guard plots contained some plants which were displaying symptoms of infection by *Phytophthora* root rot. The only exceptions were plots planted with Cowichan and Rubaca. By the onset of harvest some plants in the majority of the guard plots were dying from the disease. Plants in plots of BC 89-2-89 (Esquimalt) and Kitsilano all were dying due to this disease.

The harvest of EM 6413/59 and the SCRI selection 00123A7 started on the 26 June, two days before any of the other guard entries. EM 6487/74 had the latest harvest start of all the guards (7 July). As in previous years the period between first and 50% pick of EM 6413/59 was shorter (4 days) than for other entries, while that for Wei-Rula (24 days) was longer than any of the other guard entries. The harvest periods of EM 6413/59 (22 days) and the SCRI selection 9455E-3 (29 days) were the shortest and that of Cowichan and BC 89-34-41 (38 days) the longest in 2006.

The amount of fruit picked from the guard plots was greatly influenced by the level of plant infection by *Phytophthora* root rot, Kitsilano, 5928/114 (Malling Hestia), BC 89-2-89 (Esquimalt) and 9751E-2 being most affected. Of the entries least or apparently unaffected by this disease, BC 90-8-20, Cowichan and BC 89-34-41 (Saanich) produced the highest yield/plant of the entries planted in June 2002 and 2003. Of the SCRI selections planted in 2004, SCRI 00123A7 produced the highest yield per plant of the guard entries in 2006.

Berry weight

The berry weight of the majority of the guard entries was affected by the weather conditions of the spring and early summer months, the highest weight being achieved in 2004 and the lowest in 2006. The results are given in Tables 31, 32 and 33 for 2004, 2005 and 2006 respectively.

Table 31. Average Berry Weight (g) of guard entries in 2004

	At pick stage					
Variety/selection	**25%**	**50%**	**75%**	**Minimum**	**Maximum**	**Average for harvest**
**Rubaca®	2.40	3.28	2.88	2.40	3.48	3.02
Coho®	4.44	4.12	3.32	3.32	4.72	4.05
Wei-Rula ®	3.36	3.84	3.24	2.96	4.44	3.71
**Cowichan®	4.92	4.92	4.28	3.44	5.84	4.67
Kitsilano ®	3.60	3.08	3.00	2.40	4.00	3.23
**BC 90-8-20	4.68	4.44	4.44	3.76	4.68	4.29
**BC 90-8-11 ®	4.52	4.68	4.36	3.20	5.92	4.78
**BC 89-34-41® (Saanich)	3.72	3.76	3.64	2.64	4.28	3.57
**BC 89-2-89® (Esquimalt)	4.28	4.16	3.64	2.67	4.92	3.99
BC 89-33-84® (Chemainus)	3.52	4.40	4.00	3.00	4.60	4.06
EM 6413/59 ®	3.72	3.16	3.84	3.16	4.50	3.72
EM 6166/98® (Malling Minerva)	2.96	3.12	3.08	1.88	4.28	3.00
EM 5928/114® (Malling Hestia)	3.80	4.12	3.36	2.96	4.88	3.72
**EM 6495/53®	-	-	-	-	-	-
EM 6507/35®	3.88	3.80	3.68	2.72	5.84	3.83
EM 6487/74®	3.36	3.52	3.00	2.56	4.82	3.44
*9751E-2 (M)						
*9612F-2 (M)						
*00123A7 (M)						
*9455E-3 (M)						
*9451D-4 (M)						

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

Throughout their harvest the average berry size of BC 90-8-11 (4.78 g), Cowichan (4.67 g) and BC 90-8-20 (4.29 g) was greater and than any other guard entry.

Commercially the fruit size of EM 6166/98 (Malling Minerva), Rubaca and Kitsilano were unacceptably small.

Table 32. Average Berry Weight (g) of guard entries in 2005

	At pick stage					
Variety/selection	**25%**	**50%**	**75%**	**Minimum**	**Maximum**	**Average for harvest**
**Rubaca®	2.80	3.36	3.32	2.36	3.52	3.00
Coho®	3.6	3.84	4.24	2.92	3.84	
Wei-Rula ®	3.40	3.40	2.80	2.60	4.28	3.20
**Cowichan®	4.36	3.84	4.28	3.12	5.00	4.15
Kitsilano ®	3.12	2.64	2.72	1.68	3.76	2.87
**BC 90-8-20	5.72	4.76	5.32	3.84	6.08	5.11
**BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot					
**BC 89-34-41® (Saanich)	3.36	3.04	2.60	1.96	4.92	2.98
**BC 89-2-89® (Esquimalt)	3.80	3.88	3.88	2.64	4.08	3.60
BC 89-33-84® (Chemainus)	2.44	2.68	2.96	2.24	3.20	2.69
EM 6413/59 ®	4.24	4.32	3.52	2.96	4.52	3.61
EM 6166/98® (Malling Minerva)	2.48	2.40	2.48	2.20	3.64	2.64
EM 5928/114® (Malling Hestia)	3.12	3.28	3.16	1.96	3.59	2.93
**EM 6495/53®	3.08	3.76	3.20	2.64	3.96	3.31
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot					
EM 6487/74®	3.96	3.24	3.12	2.32	4.24	3.59
*9751E-2 (M)	2.64	2.68	3.12	2.36	3.28	2.83
*9612F-2 (M)	5.32	4.92	3.00	3.00	6.40	5.02
*00123A7 (M)	3.64	4.48	5.00	3.44	5.00	4.02
*9455E-3 (M)	5.28	4.84	4.76	4.36	6.24	5.12
*9451D-4 (M)	4.20	4.16	4.32	3.24	4.64	3.93

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

Unacceptably small berries were produced throughout the 2005 harvest by EM 6166/98 (Malling Minerva), BC 89-33-84 (Chemainus), 9751E-2, Kitsilano, EM 5928/114 (Malling Hestia), BC 89-34-41 (Saanich) and Rubaca and for most of its harvest from Wei-Rula. In contrast the fruit size of 9455E-3 and 9612F-2 was exceptionally large. The average berry weight of BC 90-80-20 and Cowichan was very good (>4.0 g) and the fruit of a consistent size throughout the 2005 harvest.

Table 33. Average Berry Weight (g) of guard entries in 2006

	At pick stage					
Variety/selection	**25%**	**50%**	**75%**	**Minimum**	**Maximum**	**Average for harvest**
**Rubaca®	3.44	3.32	3.56	2.64	3.64	3.30
Coho®	4.48	4.96	3.96	2.84	4.96	4.11
Wei-Rula ®	3.72	3.40	2.96	2.24	3.64	3.15
**Cowichan®	4.36	4.08	3.84	3.32	4.72	3.85
Kitsilano ®	3.00	2.00	2.00	2.00	3.12	2.66
**BC 90-8-20	4.84	4.60	4.40	3.28	5.40	4.38
**BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot					
**BC 89-34-41® (Saanich)	3.56	2.84	2.92	2.12	3.56	2.91
**BC 89-2-89® (Esquimalt)	Not harvested plants killed by *Phytophthora* root rot					
BC 89-33-84® (Chemainus)	Not harvested plants killed by *Phytophthora* root rot					
EM 6413/59 ®	2.32	2.64	2.28	2.16	2.64	2.34
EM 6166/98® (Malling Minerva)	Not harvested plants killed by *Phytophthora* root rot					
EM 5928/114® (Malling Hestia)	2.96	2.68	2.52	1.96	3.48	2.82
**EM 6495/53®	Not harvested plants killed by *Phytophthora* root rot					
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot					
EM 6487/74®	3.24	2.48	2.60	2.24	4.04	3.18
*9751E-2 (M)	3.20	3.08	2.36	1.96	3.28	2.63
*9612F-2 (M)	4.04	4.12	4.40	3.52	4.68	4.16
*00123A7 (M)	4.20	3.56	3.80	2.56	4.20	3.42
*9455E-3 (M)	5.20	4.28	3.64	3.24	5.56	4.31

*9451D-4 (M)	3.96	3.44	3.32	2.60	3.96	3.37

* Planted in July 2004

** Planted June 2003

® Plants propagated from root cuttings

(M) Micropropagated plants

Unacceptably small berries were produced throughout the 2006 harvest by 9751E-2, Kitsilano, EM 5928/114 (Malling Hestia), BC 89-34-41 (Saanich) and EM 6413/59. As in 2005 the fruit size of 9455E-3 was at times during its harvest exceptionally large. The average berry weight of BC 90-80-20, Coho, 9612F-2 was also very good. The average berry weight of Cowichan and 00123A was not as good or as consistent through the harvest of this variety as in the previous year.

Berry quality at harvest

The berry quality scores for samples of fruit from the guard entries for the 2004, 2005 and 2006 harvests are given in Tables 34, 35 and 36 respectively.

Table 34. Mean berry quality scores for main entries in 2004

Variety/selection	Redness	Brightness	Outline	Texture	Skin strength	Berry cohesion	Flavour
Rubaca®	2.5	4.5	4.3	2.3	2.8	4.3	2.3
Coho®	3.0	4.5	3.5	3.5	3.5	5.0	3.5
Wei-Rula ®	2.0	3.3	4.0	2.8	3.5	4.5	2.3
Cowichan®	3.0	4.7	4.3	3.0	3.5	4.8	3.0
Kitsilano ®	3.3	3.6	3.8	3.1	3.7	4.1	2.7
BC 90-8-20	3.0	4.0	4.0	4.0	4.0	5.0	3.0
BC 90-8-11 ®	3.0	4.0	4.0	3.0	4.0	4.3	3.7
BC 89-34-41® (Saanich)	2.4	3.8	4.6	2.6	3.8	4.6	2.4
BC 89-2-89® (Esquimalt)	3.0	4.0	4.0	3.4	3.6	4.6	3.6
BC 89-33-84® (Chemainus)	2.6	4.4	4.4	4.0	3.8	4.8	2.8
EM 6413/59 ®	3.5	3.3	4.0	3.3	3.5	5.0	2.5
EM 6166/98® (Malling Minerva)	3.3	3.2	4.2	3.5	3.8	5.0	3.3
EM 5928/114® (Malling Hestia)	3.0	4.4	4.2	3.4	4.0	4.2	2.4
EM 6495/53®	-	-	-	-	-	-	-
EM 6507/35®	3.0	3.0	4.0	3.0	4.0	4.3	2.3
EM 6487/74®	4.2	4.4	4.0	2.2	3.2	4.0	2.2
*9751E-2 (M)	-	-	-	-	-	-	-
*9612F-2 (M)	-	-	-	-	-	-	-
*00123A7 (M)	-	-	-	-	-	-	-
*9455E-3 (M)	-	-	-	-	-	-	-
*9451D-4 (M)	-	-	-	-	-	-	-
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. irregular 5 = even	1 = v. soft 5 = firm	1 = weak 5 = strong	1 = crumbly 5 = whole fruit	1 = v. poor 5 = v. good

*Planted in July 2004

Additional comments on results from 2004 were:

- When fully ripe the colour of the fruit of Rubaca, Wei-Rula, BC 89-34-41 (Saanich) and BC 89-33-84 (Chemainus) was a very dark pink red. Those of EM 6487/74 pale salmon pink. The fruit of all the other guard entries was mid red with the exception of those of EM 6413/59, which were pale red. The fruit of Cowichan, Rubaca, Coho, BC 89-33-84 (Chemainus), EM 5928/114 (Malling Hestia) and EM 6487/74 were very bright, glossy and attractive in appearance. Those of Wei-Rula, EM 6413/59, 6166/98 (Malling Minerva) and 6507/35 were rather dull and at times had some bloom on their surface.

- The berry outline was regular for Rubaca, Cowichan, BC 89-34-41 (Saanich), BC 89-33-84 (Chemainus) and EM 6166/98 (Malling Minerva) throughout harvest. Those of Coho were very irregular in outline throughout harvest, and for some other entries occasionally so.

- The texture of the fruit of BC 89-33-84 (Chemainus) and BC 90-8-20 was very firm throughout the harvest, while those of EM 6487/74, Rubaca, Wei-Rula and BC 89-34-41 (Saanich) were very soft. The texture of the berries of all other guard entries was comparable to that of Glen Ample.

- Skin strength of BC 90-8-20, BC 90-8-11, EM 5928/114 (Malling Hestia) and EM 6507/35 was noticeably strong and detectable when tasting fruit. Those of Rubaca were very soft and easily bruised or even ruptured by pickers.

- Berry cohesiveness of Coho, BC 90-8-20, BC 89-33-84 (Chemainus), EM 6413/59, Cowichan and 6166/98 (Malling Minerva) was excellent. All other guard entries sometimes produced fruit with a tendency to crumble, particularly near the end of harvest.

- The flavour of the fruit produced by Coho, BC 90-8-11 and BC 89-2-89 (Esquimalt) was excellent. The taste of Cowichan and BC 90-8-20 waste generally good but lacked any distinction. In contrast the fruit of Rubaca, Wei-Rula and EM 6507/35

at times had a very unpleasant taste being acid or rather musky. The taste of Kitsilano, BC 89-34-41 (Saanich), BC 89-33-84 (Chemainus), EM 6413/59, 5928/114 (Malling Hestia) and EM 6487/74 were rather bland.

Table 35. Mean berry quality scores for main entries in 2005

Variety/selection	Redness	Brightness	Outline	Texture	Skin strength	Berry cohesion	Flavour
Rubaca®	2.6	4.0	3.6	**2.2**	3.4	4.6	**2.0**
Coho®	3.0	4.8	3.2	3.6	4.0	3.6	3.0
Wei-Rula ®	2.0	3.7	3.7	2.3	4.0	3.7	2.3
Cowichan®	3.0	4.7	4.7	3.2	3.8	5.0	3.2
Kitsilano ®	3.0	4.2	4.2	3.2	4.4	4.6	2.6
BC 90-8-20	2.2	3.0	3.8	3.4	4.6	4.4	3.4
BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot						
BC 89-34-41® (Saanich)	2.8	3.8	4.5	2.5	3.3	4.8	2.7
BC 89-2-89® (Esquimalt)	3.2	4.0	3.6	3.2	3.6	4.4	2.8
BC 89-33-84® (Chemainus)	2.7	4.0	4.0	3.0	3.7	4.0	3.7
EM 6413/59 ®	3.0	3.5	3.7	2.3	3.3	4.7	3.0
EM 6166/98® (Malling Minerva)	2.5	2.8	4.0	3.5	4.0	4.8	3.0
EM 5928/114® (Malling Hestia)	2.6	3.8	3.6	3.5	4.3	4.5	2.5
EM 6495/53®	2.7	4.3	4.0	2.7	4.0	5.0	2.7
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot						
EM 6487/74®	4.3	4.3	4.0	2.7	3.7	4.3	2.7
*9751E-2 (M)	2.8	4.5	4.0	3.8	4.5	4.0	3.8
*9612F-2 (M)	2.8	4.4	4.2	4.4	4.4	3.8	3.2
*00123A7 (M)	3.0	4.5	3.5	3.0	4.0	4.3	4.0
*9455E-3 (M)	2.7	3.7	4.2	3.8	4.5	5.0	3.7
*9451D-4 (M)	2.8	4.0	4.6	4.0	5.0	4.8	3.0

1 = v. dark	1 = v. dull	1 = v. irregular	1 = v. soft	1 = weak	1 = crumbly	1 = v. poor
5 = pale	5 = bright	5 = even	5 = firm	5 = strong	5 = whole fruit	5 = v. good

*Planted in July 2004

Additional comments on results from 2005 were:

- When fully ripe the colour of the fruit of Rubaca, Wei-Rula, BC 90-8-20 was a very dark pink red. The fruits of BC 89-34-41 (Saanich) and BC 89-33-84 (Chemainus), EM 6166/98 (Malling Minerva), 5928/114 (Malling Hestia), 6495/53, 9751E-2, 9612F-2, 9455E-3 and 9451D-4 at times during the harvest ripened to dark red . The fruit of EM 6487/74 were consistently pale salmon pink. The fruit of all the other guard entries were mid red. The fruit of Cowichan, Coho, 9751E-2 9612F-2 and 00123A7 were very bright and glossy. Those of BC 90-8-20 and 6166/98 (Malling Minerva) rather dull, all other entries had a bright appearance.

- The berry shape of Cowichan and 9451D-4 was very even, while those of Coho were very uneven throughout harvest. The fruit of all of the other guard entries occasionally was unevenly set noticeably towards the end of their respective harvest.

- The berries of Rubaca, Wei-Rula, BC 89-34-41 (Saanich), EM 6495/53, 6413/59 and 6487/74 were very soft when fully ripe and those of 9751E-2, 9612F-2, 9455E-3, 9451D-4 very firm. The berry texture of the other guard entries was similar to that of either Glen Ample or Tulameen.

- The skin strength of BC 90-8-20, Kitsilano, EM 5928/114 (Malling Hestia), 9751E-2, 9455E-3 and particularly 9451D-4 was very strong and in the case of BC 90-8-20 and Kitsilano detectable when tasting fruit. The skin of the fruit of Rubaca, BC 89-34-41 (Saanich) and EM 6413/59 were easily bruised and damaged so that individual drupes bled.

- The berries of Cowichan, EM 6495/53 and 9455E-3 were exceptionally cohesive, those of Rubaca, Kitsilano, BC 89-34-41 (Saanich), EM 6413/59, 6166/98 (Malling Minerva) and 9451D-4 were also very cohesive. Small quantities of fruit produced by the other guard entries at the start and towards the end of their respective harvests were found to lack cohesion and were subject to tearing or crumble.

- The flavour of the berries of Wei-Rula, Rubaca, Kitsilano, BC 89-34-41 (Saanich), BC 89-2-89 (Esquimalt), EM 5928/114 (Malling Hestia), 6495/53 and 6487/74 was very poor and that of BC 89-33-84 (Chemainus), 9751E-2, 9612F-2 and 00123A7 excellent. The berry flavour of Cowichan and 9612F-2 was also good.

Table 36. Mean berry quality scores for main entries in 2006

Variety/selection	Redness	Brightness	Outline	Texture	Skin strength	Berry cohesion	Flavour
Rubaca®	2.3	4.0	4.0	2.0	2.5	4.8	2.0
Coho®	3.0	4.5	3.0	3.3	3.8	4.0	3.0
Wei-Rula ®	2.0	4.3	4.0	2.3	3.0	4.3	2.3
Cowichan®	3.0	5.0	4.8	3.0	3.8	4.8	3.5
Kitsilano ®	3.0	5.0	4.7	3.7	4.7	5.0	2.0
BC 90-8-20	2.0	2.5	4.0	3.3	3.8	4.3	3.8
BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot						
BC 89-34-41® (Saanich)	2.8	4.3	4.5	3.0	4.3	5.0	2.3
BC 89-2-89® (Esquimalt)	Not harvested plants killed by *Phytophthora* root rot						
BC 89-33-84® (Chemainus)	Not harvested plants killed by *Phytophthora* root rot						
EM 6413/59 ®	2.0	4.5	4.5	2.5	3.0	4.5	3.0
EM 6166/98® (Malling Minerva)	Not harvested plants killed by *Phytophthora* root rot						
EM 5928/114® (Malling Hestia)	3.0	5.0	4.3	4.0	4.3	4.3	4.0
EM 6495/53®	Not harvested plants killed by *Phytophthora* root rot						
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot						

EM 6487/74®	4.0	4.3	3.7	2.3	3.3	4.3	2.3
*9751E-2 (M)	2.8	4.8	3.8	3.5	4.8	4.5	3.0
*9612F-2 (M)	3.0	4.5	4.0	3.5	4.0	4.3	2.8
*00123A7 (M)	3.0	4.0	4.0	4.0	4.0	4.3	3.0
*9455E-3 (M)	3.0	4.3	4.3	3.0	4.7	4.7	2.3
*9451D-4 (M)	3.0	4.8	4.3	3.8	4.8	4.0	3.5
	1 = v. dark	1 = v. dull	1 = v. irregular	1 = v. soft	1 = weak	1 = crumbly	1 = v. poor
	5 = pale	5 = bright	5 = even	5 = firm	5 = strong	5 = whole fruit	5 = v. good

*Planted in July 2004

Additional comments on the results from 2006 were:

- When fully ripe, the berries of Rubaca, Wei-Rula, BC 90-8-20, EM 6413/59 and 9751E-2 were unacceptably dark. Those of BC 89-34-41 (Saanich) were also a dark red when ripe. In contrast the fruit of Coho, Cowichan, Kitsilano, EM 5928/114 (Malling Hestia) and the SCRI selections 9612F-2, 00123A7, 9455E-3 and 9451D-4 throughout harvest were an attractive mid-red in colour.

- Cowichan, Kitsilano, EM 5928/114 (Malling Hestia), 9751E-2 and 9451D-4 produced fruit which were exceptionally bright and glossy. Apart from BC 90-8-20 and Rubaca produced fruit which had a very dull appearance, the fruit of all other entries looked bright, but not as glossy as the best performing selections.

- The berry shape, drupelet size and set of Cowichan and Kitsilano were uniform throughout harvest. Berry shape of BC 89-34-41 and EM 6413/59 was also very regular, but both produced fruit which comprised drupelets of very variable size. There was some variation in berry shape at some stage during the harvest of all the other guard entries.

- The fruit of Rubaca, Wei-Rula, EM 6413/59 and EM 6487/74 were very soft, collapsed, melted and became unmarketable very rapidly after picking.

Those of EM 5928/114 (Malling Hestia), 00123A7, Kitsilano and 9451D-4 were very firm even when very ripe. The texture of all the other guard entries was similar to that of Tulameen or Glen Ample.

- The skins of the berries of Cowichan, Coho, BC 89-34-41 (Saanich) BC 90-8-20, 912F-2 and 00123A7 were assessed as strong and similar to that of Tulameen in that they were unobtrusive when the berries were eaten. The fruit of Kitsilano, 9751E-2, 9455E-3 and 9451D-4 were very strong and rarely bruised or punctured by pickers. However in the case of Kitsilano and 9455E-3 they were prominent when the berries were eaten, which made sampling the fruit an unpleasant experience.

- As in previous seasons the skins of the drupes of Rubaca, Wei-Rula, and EM 6413/59 were rather soft and readily bruised or even punctured in the case of Rubaca and Wei-Rula by the slightest rough handling of ripe fruit.

- The fruit of Rubaca, Cowichan, Kitsilano, BC 89-34-41 (Saanich) and 9455E-3 were very cohesive. At some stage of their harvest the other guard entries produced small amounts of fruit which either crumbled or tore when being picked.

- In 2006 the guard entries that were assessed to have produced the best flavoured fruit were, BC 90-8-20, EM 5928/114 (Malling Hestia), 9451D-4 and Cowichan; those with the poorest flavour were Rubaca, Wei-Rula, Kitsilano, BC 89-34-41 (Saanich), EM 6487/74 and 9455E-3. The flavour of the fruits harvested from the other guard entries was satisfactory but lacked any real distinction.

Shelf life

The results of the shelf life assessments for the guard entries in each of the three years are given in Tables 37, 38 and 39.

Additional comments on the 2004 results were:

- On removal from cold store the berries of Wei-Rula, EM 6507/35 and 6487/74 were consistently found to be either collapsed or at the point of collapse. in the case of Rubaca, BC 89-34-41 (Saanich) and EM 6495/53, the texture of the berries had deteriorated to the extent that they were very close to being unmarketable.

- The berries of Coho, BC 90-8-11, 89-33-84 (Chemainus) and EM 5928/114 (Malling Hestia) were still very firm had changed little in storage. Those of Cowichan, BC 89-2-89 (Esquimalt), EM 6413/59 and 6166/98 (Malling Minerva) had softened slightly but were still marketable.

- The appearance of the berries of Rubaca, Coho, Cowichan, BC 90-8-11, BC 89-33-84 (Chemainus), EM 5928/114 (Malling Hestia) and 6413/59 post cold storage was bright attractive and very similar to that as picked. The berries of BC 89-34-41 (Saanich), 89-2-89 (Esquimalt and EM 6166/98 (Malling Minerva) were bright but they had become a very dark red making them appear over ripe.

Table 37. Average shelf-life scores for guard entries in 2004

Variety/selection	Rotten Berries	Berry Texture	Appearance
Rubaca®	5.0	3.0	4.0
Coho®	5.0	4.0	4.0
Wei-Rula ®	5.0	2.5	2.5
Cowichan®	5.0	3.5	4.0
Kitsilano ®	5.0	3.0	3.5
BC 90-8-20	-	-	-
BC 90-8-11 ®	5.0	3.5	4.0
BC 89-34-41® (Saanich)	5.0	2.8	3.8
BC 89-2-89® (Esquimalt)	5.0	3.6	3.9
BC 89-33-84® (Chemainus)	5.0	3.8	4.2
EM 6413/59 ®	5.0	3.5	3.8
EM 6166/98® (Malling Minerva)	5.0	3.8	3.5
EM 5928/114® (Malling Hestia)	5.0	3.8	4.0
EM 6495/53®	5.0	3.2	3.3
EM 6507/35®	5.0	2.7	3.0
EM 6487/74®	5.0	1.6	3.4
*9751E-2 (M)	-	-	-
*9612F-2 (M)	-	-	-
*00123A7 (M)	-	-	-
*9455E-3 (M)	-	-	-
*9451D-4 (M)	-	-	-
	1 = 5 or more rotten fruit 5 = no rotten fruit	1 = collapsed 5 = as picked	1 = very dull 5 = very bright

*Planted in July 2004

Table 38. Average shelf-life scores for guard entries in 2005

Variety/selection	Rotten Berries	Berry Texture	Appearance
Rubaca®	4.8	2.0	2.5
Coho®	5.0	2.8	3.0
Wei-Rula ®	5.0	2.0	2.0
Cowichan®	5.0	3.4	3.7
Kitsilano ®	5.0	3.6	3.6
BC 90-8-20	5.0	2.6	2.6
BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot		
BC 89-34-41® (Saanich)	5.0	3.0	3.0
BC 89-2-89® (Esquimalt)	5.0	3.0	3.6
BC 89-33-84® (Chemainus)	5.0	3.4	3.5
EM 6413/59 ®	5.0	2.0	2.7
EM 6166/98® (Malling Minerva)	5.0	3.0	2.8
EM 5928/114® (Malling Hestia)	5.0	4.0	4.0
EM 6495/53®	5.0	2.7	3.3
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot		
EM 6487/74®	5.0	2.0	2.7
*9751E-2 (M)	5.0	3.5	3.5
*9612F-2 (M)	5.0	4.0	3.5
*00123A7 (M)	5.0	3.5	4.0
*9455E-3 (M)	5.0	4.3	4.3
*9451D-4 (M)	5.0	4.7	4.3
	1 = 5 or more rotten fruit 5 = no rotten fruit	1 = collapsed 5 = as picked	1 = very dull 5 = very bright

*Planted in July 2004

Additional comments on the 2005 results were:

- Berries of Rubaca, Wei-Rula, Coho, BC 90-8-20, 89-34-41 (Saanich), 89-2-89 (Esquimalt), EM 6413/59, 6166/98 (Malling Minerva), 6495/53 and 6487/74 were unmarketable following cold storage throughout the 2005 harvest.

- Fruit of Cowichan, Kitsilano and BC 89-33-84 (Chemainus) on some occasions during the 2005 harvest had become too soft or dark post cold storage to be marketable.

- Fruit of 9451D-4, 9455E-3, 00123A7, 9612F-2 and 9751E-2 were generally bright, firm and marketable post cold storage although some fruit of 00123A7 and 9455E-3 had suffered solar damage in the field pre-picking.

- Although the fruit of 9612F-2 had become a very dark red and a little dull in appearance it was still considered marketable.

Table 39. Average shelf-life scores for guard entries in 2006

Variety/selection	Rotten Berries	Berry Texture	Appearance
Rubaca®	5.0	2.0	2.5
Coho®	5.0	3.0	4.0
Wei-Rula ®	5.0	2.0	3.0
Cowichan®	5.0	3.5	4.0
Kitsilano ®	-	-	-
BC 90-8-20	5.0	3.0	3.5
BC 90-8-11 ®	Not harvested plants killed by *Phytophthora* root rot		
BC 89-34-41® (Saanich)	5.0	3.0	3.5
BC 89-2-89® (Esquimalt)	Not harvested plants killed by *Phytophthora* root rot		
BC 89-33-84® (Chemainus)	Not harvested plants killed by *Phytophthora* root rot		
EM 6413/59 ®	-	-	-
EM 6166/98® (Malling Minerva)	Not harvested plants killed by *Phytophthora* root rot		
EM 5928/114® (Malling Hestia)	5.0	3.0	3.0
EM 6495/53®	Not harvested plants killed by *Phytophthora* root rot		
EM 6507/35®	Not harvested plants killed by *Phytophthora* root rot		

EM 6487/74®	5.0	3.0	4.0
*9751E-2 (M)	5.0	4.0	3.5
*9612F-2 (M)	4.7	4.0	4.3
*00123A7 (M)	5.0	3.0	4.0
*9455E-3 (M)	5.0	4.5	2.5
*9451D-4 (M)	5.0	4.5	4.0
	1 = 5 or more rotten fruit 5 = no rotten fruit	1 = collapsed 5 = as picked	1 = very dull 5 = very bright

*Planted in July 2004

Additional comments on the 2006 results were:

- Fruit of Rubaca and Wei-Rula were unmarketable post cold storage. For EM 6487/74, fruit were in good condition and attractive in appearance when taken from store but rapidly thereafter deteriorated and became unmarketable. Fruit of BC 89-34-41 (Saanich) very dark when removed from store so that although the berry texture was still reasonably firm the fruit appeared over ripe. BC 90-8-20 and EM 5928/114 (Malling Hestia) fruit were reasonably firm and bright on removal from store but there was some variation in drupelet colour which made the fruit unmarketable.

- Fruit of Cowichan softened by end of cold storage, but the fruit were bright, attractive and marketable.

- The shelf life of 9451D-4 was excellent, with the berries of this SCRI selection being bright, firm and with good flavour after cold storage. The fruit of the other SCRI guard entries were also marketable post cold storage. However the surface of the berries of 9455E-3 looked rather dull, some bloom had developed on the

surface of the berries of 9751E-2 and the texture of the fruit of 00123A7 had softened although their appearance was bright and attractive.

- The texture of the berries of 9612F-2 had changed little since their harvest and was still very firm. Their appearance was very bright and attractive but berry flavour was bland.

Market acceptability

Appraisal by supermarket technologists: the results of the appraisals done by technologists from supermarkets in 2005 are given in Tables 40 (Sainsburys), 41 (Marks & Spencer), and 42 (Waitrose).

Table 40. Assessments of fruit characteristics by Sainsburys technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 14 July 2005				
Tulameen	3	4	4	Sample typical of variety
Glen Ample	3	4	4	Sample typical of variety
Rubaca	2	2	2	Very soft & crunchy seeds
Cowichan	3	1	3	Looks like Tulameen, bland flavour
EM 6413/59	3	3	2	Soft, light colour, sweet, unusual flavour
BC 89-2-89 (Esquimalt)	3	4	4	Sweet, good flavour has potential
EM 6166/98 (Malling Minerva)	3	1	4	Firm, Small, conical berries, no flavour
BC 89-34-41 (Saanich)	3	2	2	Rich flavour, dark, drupes variable in colour
b) 22 July 2005				
Tulameen	4	5	4	Sample typical of variety
Glen Ample	4	5	4	Sample typical of variety
Octavia	4	3	4	Variable flavour, sweetness but slightly bitter
Coho	4	1	4	Lacks flavour
c) 5 August 2005				
Tulameen	1	1	1	Very soft bleeding poor
Glen Ample	4	3	2.5	Slight sweetness
Octavia	3	1	4	Bland flavour, lacks sugar
Cowichan	4	1	3	Deep attractive red colour, poor flavour
BC 89-34-41 (Saanich)	1	2	1	Very soft & very dark in colour
BC 90-8-20	1	1	1	Very soft over ripe, some rots
	1 = poor 5 = excellent	1 = poor 5 = excellent	1 = very soft 5 = firm	

Table 41. Assessments of fruit characteristics by Marks & Spencer technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 12 July 2005				
Tulameen	4.5	4	3	Best appearance/ eating quality
Glen Ample	3.5	3	3	
Rubaca	2.5	3	3	Small fruit
BC 89-2-89 (Esquimalt)	3	2	2	-
Cowichan	3.5	3.5	3	Second best sample of fruit supplied
EM 6413/59	3	3	2	-
BC 89-34-41 (Saanich)	3.5	2	3	-
EM 6166/98 (Malling Minerva)	2.5	2	3	Small berries

Table 42 Assessments of fruit characteristics by Waitrose technologist, 2005

Variety/selection	Appearance	Flavour	Firmness	Comments
a) 1 August 2005				
Tulameen	3	5	4	Poor appearance, uneven shape & colour
Glen Ample	4	1	4	Not sweet
Octavia	3	2	4	Poor flavour
Cowichan	2	1	4	Hairy berries, small, watery flesh & bland
	1 = poor 5 = excellent	1 = poor 5 = excellent	1 = very soft 5 = firm	

With the exception of Waitrose, Cowichan was considered to have a good appearance and to have fruit as firm as or slightly softer than those of Glen Ample and Tulameen. However with the exception of the sample of fruit of this cultivar sent to Marks & Spencer on the 12 July 2005 the flavour of this cultivar was assessed as being weak.

The flavour of the fruit of Coho, BC 89-2-89 (Esquimalt), BC 89-34-41 (Saanich), EM 6166/98 (Malling Minerva) and BC 90-8-20 was consistently appraised as poor and that of EM 6413/59 and Rubaca inconsistent but on one occasion on a par with that of Glen Ample.

The berry size of EM 6166/98 (Malling Minerva) and Rubaca were unacceptably small.

Appraisal by farm shop customers: the results of the appraisals done by customers at Rectory Farm Shop in July 2005 are given in Table 43.

Table 43. Average scores (out of 100) for samples of fruit assessed by retail customers

Date Variety/ Selection	**Do you like the fruits appearance?**		**Do you like the fruits texture?**		**Do you like the fruits flavour?**		**Would you purchase this variety/selection ?**	
	Yes	No	Yes	No	Yes	No	Yes	No
a) 8 July 2005								
Glen Ample	94	6	89	11	67	33	70	30
Cowichan	89	11	75	25	68	32	68	32
b) 9 July 2005								
Tulameen	100	-	94	6	94	6	91	9
EM 6413/59	86	14	83	17	61	39	61	39
EM 6166/89 (Malling Minerva)	55	45	57	43	47	53	43	57

Cowichan was the most acceptable of the small number of guard entries that were assessed by the public.

The results for the 2005 the assessments done by Charis Food from Thought are given in Tables 44 to 46.

Table 44. Fruit appearance (rating 1-100) as assessed by Charis Food for Thought, July 2005.

Genotype	Red	Brown	Purple	Uniform	Size
9612F-2	60.9	0.4	14.1	59.2	57.8
9455E3	55.2	0.0	8.3	54.9	59.4
Glen Ample	58.4	0.1	8.0	62.4	54.8
Tulameen	61.5	0.4	10.5	56.2	55.5

Comments were as follows:

Redness: 9455E3 was assessed as having the least red in colour.

Brown: all selections/cultivars had a very low score for browness.

Purple: of the guard entries 9612F-2 was judged to be the most purple and 9455E3 the least purple in their colour

Uniformity: the berries of 9612F-2 were more uniform in colour than those of Tulameen. The least uniform of all the SCRI entries sent for appraisal were those of 9455E3

Berry size: of the guard entries the size of the berries of 9612F-2 was the least and 9455E3 the most uniform. Uniformity of berry size of both of these selections was however superior to both Glen Ample and Tulameen.

Table 45. Fruit flavour (rating 1-100) as assessed by Charis Food for Thought, July 2005.

Genotype	Fruity	Sweet	Woody	Acid/Sour	Raspberry	Grassy	Bitter	Floral
9612F-2	47.8	24.0	7.3	40.4	45.2	7.7	6.5	10.1
9455E3	49.7	19.7	2.6	50.1	42.3	9.5	9.8	9.5
Glen Ample	56.9	22.2	5.3	40.6	53.6	5.1	6.7	14.8
Tulameen	56.8	27.0	8.0	38.6	52.3	10.0	4.6	18.1

Comments were as follows:

Fruity: 9612F-2 and 9455E3 had lower scores for a fruity flavour than either Glen Ample or Tulameen.

Sweet: 9612F-2 was appraised to be sweeter and 9455E3 less sweet than Glen Ample or Tulameen

Woody: 9455E3 and Glen Ample had the lowest scores.

Acid/sour: 9455E3 had the highest acid/sour flavour.

Raspberry: 9455E3 had the lowest score.

Grassy: Tulameen and 9455E3 had the highest score.

Bitter: 9455E3 had the highest bitter score and Tulameen had the lowest Sensory appraisal

Floral: 9455E3 had the lowest score.

Table 46. After taste, mouth-feel and acceptability rating (1-100) as assessed by Charis Food for Thought, July 2005.

Genotype	After taste		Mouth feel			
	Intensity	Persistence	Firmness	Seedy	Juicy	Acceptability
9612F-2	35.4	31.8	58.4	39.3	38.4	46.1
9455E3	37	34.1	42.6	34.7	42	39.5
Glen Ample	39.1	36.3	53.5	38.4	35	50.6
Tulameen	37.5	32.3	53.1	40.2	40.1	55.0

Comments were as follows:

Intensity: the intensity of after-taste of 9455E3 was on a par with that of Tulameen but less than that of Glen Ample.

Persistence: in comparison with Tulameen, the persistence of after- taste was slightly less with 9612F-2 and lightly longer with 9455E3.

Firmness: 9455E3 was judged to be soft and 9612F-2 firmer in the mouth than Tulameen or Glen Ample.

Seedy: 9455E3 was judged to have the most prominent seeds.

Juicy: the berries of 9455E3, 9612F-2 and Tulameen were assessed to be juicier, than those of Glen Ample.

Acceptability: the score achieved for 9612F-2, was slightly less than and that of 9455E3 far lower than that of Glen Ample or Tulameen.

The results for the 2006 the assessments done by Sensory Scotland Ltd are given in Tables 47 to 49.

Table 47. Fruit appearance (rating 1-100) as assessed by Sensory Scotland Ltd, July 2006

Genotype	Red	Brown	Purple	Uniform	Size
9612F-2	59.8	-0.1	33.2	59.3	47.5
Glen Ample	61.8	0.3	27.5	61.6	46.2
Tulameen	70.5	0.4	18.3	62.8	55.9

Comments were as follows:
Redness: the fruit of 9612F-2 had a less intense red colour than those of Glen Ample or Tulameen.

Brown: 9612F-2 had higher brown colour than Glen Ample or Tulameen

Purple: the fruit of 9612F-2 was more purple than those of Glen Ample or Tulameen.

Uniform: 9612F-2 was assessed to be as uniform in colour as Tulameen and Glen Ample. *Berry size*: the fruit of 9612F-2 had a similar uniformity of size as that of Glen Ample.

Table 48. Fruit flavour (rating 1-100) as assessed by Sensory Scotland Ltd, July 2006

Genotype	Fruity	Sweet	Woody	Acid/Sour	Raspberry	Grassy	Bitter	Floral
9612F-2	49.3	24.2	9.3	39.3	38.9	14.9	8.2	12.7
Glen Ample	52.8	28.3	8	35.2	44.4	9.6	4.2	16.0
Tulameen	52.8	28.8	8.5	37.8	42.4	11.6	7.7	12.9

Comments were as follows:

Fruity. Glen Ample and Tulameen were judged to have a fruitier flavour than 9612F-2.

Sweet: 9612F-2 had the lowest score for sweetness.

Woody: 9612F-2 had a slightly higher level of woodiness detected in the berry flavour than either Glen Ample or Tulameen.

Acid/Sour: Glen Ample and Tulameen had a slightly higher score for acid/sour flavour than 9612F-2

Raspberry: the fruit of all the selections/varieties tested had a distinct raspberry flavour

Grassy: 9612F-2 had the highest for grassy tones.

Bitter: most of the selections had similar scores with the exception of Glen Ample which achieved a low score.

Floral: Tulameen and 9612F-2 had a virtually identical score for floral smell/taste.

Table 49. After taste, mouth-feel and acceptability rating (1-100) as assessed by Sensory Scotland Ltd, July 2006

Genotype	After taste		Mouth feel			
	Intensity	Persistence	Firmness	Seedy	Juicy	Acceptability
9612F-2	35.7	31.6	40.4	31.2	32.2	37.9
Glen Ample	36.5	32.1	41.7	27.3	33.9	48.4
Tulameen	39.3	36.3	28.6	27.4	49.7	42.4

Comments were as follows:

Intensity: the flavour of the fruit of Tulameen was more intense than that of Glen Ample or 9612F-2.

Persistence: Tulameen had the most persistent after-taste, that of 9612F-2 being slightly less than that of Glen Ample.

Firmness: Glen Ample and 9612F-2 had the firmest fruit.

Seedy: Glen Ample and 9612F-2 had similar and Tulameen the lowest score and the softest fruit.

Juicy: Tulameen had the most and 9612F-2 and Glen Ample the least juicy fruit.

Acceptability: Glen Ample had the highest and 9612F-2 the lowest level of acceptability.

Grower assessment at Open Days: the results of the grower assessments done at the HDC Open Days on 6 July 2004 and 14 July 2006 are given in Tables 50 and 51.

Table 50. Average scores for the main entries assessed at HDC Open Day on 6 July 2004

Variety/Selection	Redness	Brightness	Texture	Flavour	Commercial potential
Glen Ample	3.3	3.9	2.8	3.9	No
Tulameen	3.2	3.9	3.4	4.1	Yes
EM 5928/114 (Malling Hestia)	3.1	3.0	3.0	3.1	Yes
EM 6166/98 (Malling Minerva)	2.7	2.8	3.1	2.3	No
EM 6413/59	3.3	3.1	2.6	2.9	No
EM 6487/74	5.0	2.5	2.1	2.3	No
EM 6507/35	2.8	2.7	2.9	2.5	Possibly
Kitsilano	3.0	3.0	3.7	2.2	No
BC 89-33-84 (Chemainus)	3.0	3.0	3.5	2.4	Yes
Wei-Rula	3.0	2.5	2.5	3.7	Yes
BC 89-2-89 (Esquimalt)	3.0	2.7	3.0	2.7	Possibly
BC 89-34-41 (Saanich)	2.3	2.7	2.8	2.3	No
Cowichan	2.6	4.0	2.3	3.1	Yes
Rubaca	1.4	2.8	1.0	3.6	Possibly
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. soft 5 = firm	1 = v. poor 5 = v. good	

Table 51. Average scores for the main entries assessed at HDC Open Day on 14 July 2006

Variety/Selection	Redness	Brightness	Texture	Flavour	Commercial potential
Glen Ample	3.5	3.0	3.0	3.0	Yes
Tulameen	3.5	3.5	2.5	4.0	Yes
Coho	3.0	3.4	2.9	2.4	No
Cowichan	3.3	3.8	3.8	3.1	Yes
BC 90-8-20	2.8	3.0	2.9	3.7	Possibly
BC 89-34-41 (Chemainus)	2.8	2.8	2.7	2.5	No
9451D4	2.7	2.7	3.7	2.0	No
9455E3	2.5	2.9	3.1	2.0	No
9612F-2	3.0	3.3	3.5	2.1	No
9751E-2	2.7	2.5	2.0	2.0	No
Rubaca	2.5	2.3	2.2	3.6	No
	1 = v. dark 5 = pale	1 = v. dull 5 = bright	1 = v. soft 5 = firm	1 = v. poor 5 = v. good	

In 2004 EM 5928/114 (Malling Hestia), BC 89-33-84 (Chemainus), Wei-Rula and Cowichan were considered to have commercial potential. Wei-Rula had exceptionally good berry flavour; Chemainus, Malling Hestia and Cowichan had an attractive mid-red colour, firmness and brightness of their fruit. Of the cultivars and selections appraised in 2006 only Cowichan was considered to have commercial potential. Its fruit were very bright, mid-red, firm, with a flavour similar to that of Glen Ample but not as good as that of Tulameen, BC 90-8-20 or Rubaca.

Plant characteristics of guard entries

The plant characteristics of the main entries are described below. The fruit characteristics for these varieties are given in Table 52.

EM 6413/59: primocane is tall, of medium thickness, spine free, leafy, pleasant to handle and prune, upright to slightly spreading in habit and produced in adequate numbers. The foliage canopy is rather dense which can obscure fruit from pickers.

Some flower production at tips of primocane in the late summer and early autumn period. If primary fruiting laterals are damaged by frost, numerous secondary and tertiary laterals are produced to replace them. Fruit laterals vary in length according to their position from medium to short with an ascending habit in the upper third, to medium length horizontal to slightly drooping on the remainder of the length of cane. They are well-attached, spine-free, leafy and present fruit well for picking but are brittle and prone to breakage during harvest by strong winds or heavy rain.

BC 89-2-89 (Esquimalt): very tall upright in habit, stout, spine-free primocane, produced in adequate numbers. Fruit presented well to pickers on spine-free laterals which slightly droop over at their tip and, according to their position on the cane, vary from medium to very long in length. These are strongly attached and leafy. Picking is pleasant and easy.

EM 6166/98 (Malling Minerva) primocane spine-free, tall, upright to slightly spreading at their top, adequate in number. The primocane habit of this selection ensures that during harvest the fruit is well displayed to pickers. Fruiting laterals prone to breakage during harvest at their tip by strong winds or the weight of fruit, other wise fruit presented well to pickers, on medium-long (lower half of floricane) well spaced out laterals held for most of the canes' height at or just below horizontal.

BC 89-33-84 (Chemainus): very tall, stout cane, produced in adequate numbers, spine-free except at their base, upright in habit and pleasant to handle at all times. The canes of juvenile plants have a tendency to produce side shoots, pre- and post-harvest. The fruiting laterals of Chemainus are strongly attached, leafy, spine-free and displayed fruit reasonably well to pickers. Laterals at top of the canes are short and ascending in habit; the lower ones very long, held horizontal or slightly drooping. The fruit is well spaced out on the laterals making picking easy and pleasant.

BC 90-8-20: the canes of BC 90-8-20 are very tall, stout, produced in adequate numbers and are leafy, very spiny, upright in habit and unpleasant to handle at all times. The laterals of BC 90-8-20 are strongly attached, leafy, spiny and display fruit well to pickers. Those at the top of the canes are of medium length, ascending in habit and those positioned lower very long and slightly drooping. The fruits are well spaced out on the laterals; picking is reasonably pleasant.

Rubaca: small spines the full length of canes which are stout, erect, adequate in number and easy to manage. Laterals bear spines and are unpleasant to handle, are strongly attached and not easily damaged during harvest; short to medium in length, slightly to strongly ascending in habit, displaying fruit quite well to pickers.

Kitsilano: very spiny canes, tall upright in habit, produced in adequate numbers, have a tendency to branch, very difficult and unpleasant to handle, prune or train. According to their position, fruiting laterals very long from middle to base of the cane; medium length at the top of cane. Very spiny with the longer laterals having a pronounced drooping habit, so that they roll over each other making picking very difficult, slow and unpleasant.

BC 90-8-11: primocane very tall, some over 2.5 m by end of growing season, stout, produced in adequate numbers, bear some spines, very upright in habit and pleasant to handle at all times. The foliage canopy of BC90-8-11 is noticeably sparser than that of the other PARC selections entered in the trial. Fruiting laterals strongly attached, are fairly leafy, bear spines and display fruit well to pickers. Laterals at top of the canes are of medium length, horizontal in habit and those positioned lower long and slightly drooping. The fruits are well spaced out on the laterals, picking is pleasant.

EM 6507/35: very spiny canes which at all stages of their development are extremely unpleasant to handle. The primocane of this selection can be tall, stout and present in adequate numbers. The presence of spines and the canes' upright then spreading habit hampers harvest unless primocane support and training prior to and throughout harvest is appropriately carried out. The floricane bears very long, drooping laterals, immediately above and below their centre and strongly ascending medium length ones towards their top. These are weakly attached, so that a high percentage of them are usually broken by mid harvest, these traits making the rate of picking achieved for this selection for most of the harvest far slower that achieved for the other guard and main entries in the trial.

EM 6487/74: very spiny primo and floricane, which are at all stages of their development are extremely unpleasant to handle; tall or very tall, having an initially

upright and then very spreading habit, of moderate thickness, brittle (easily broken in two) and present in adequate numbers. Spines and the spreading habit of primocane can seriously hamper harvest unless primocane is provided with adequate support, so that they can be held upright and away from the fruit laterals, prior to and throughout this selections harvest. Fruiting laterals very long and drooping in habit immediately above and below the centre and horizontal, or slightly drooping and of medium length towards the top of floricane. Strongly attached, with only a small number broken during harvest, the berries are borne on long stalks and are well spaced out on fruiting laterals and although they are well displayed to pickers, the spines on both primocane and laterals made searching for and detachment of fruit unpleasant.

9612F-2: spine free, upright to spreading cane, which have a very waxy rind, readily splitting at their base. Moderate or sparse number of canes produced generally of medium height and diameter. Fruiting laterals very short in upper section and, in contrast, very long, towards the base of cane. All strongly ascending in habit, well-attached, very leafy, typically many branched, presenting a wall of easily detached fruit to pickers.

9751E-2: spine free, upright to spreading habit, very waxy rind with some splitting at base of primocane. Canes short or of medium length, adequate, never excessive in number. Fruiting laterals with the exception of those at base of the cane of medium length, all ascending in habit, well attached, multi-branched, presenting a wall of fruit to pickers, with berries easy to detach.

BC 89-34-41 (Saanich): very tall, stout, upright canes which with the exception of their base are spine-free, produced in adequate but not excessive in numbers. The fruiting laterals of BC89-34-41 (Saanich) are strongly attached, leafy, spine-free and display fruit reasonably well to pickers. Laterals at top of the canes are of medium length, ascending in habit and those positioned lower very long and drooping. The fruits are well spaced out on the laterals, picking is pleasant.

EM 5928/114 (Malling Hestia): canes are of medium or tall height, medium in diameter, produced in adequate but not excessive numbers, bear spines, are upright to spreading in habit, but are not unpleasant to handle. With suitable training

and support the primocanes of this selection do not inhibit picker access to the fruit at harvest. The laterals are strongly attached at their base but their tips are brittle and easily broken during harvest. More or less spine-free, the uppermost laterals are short or of medium length and those positioned lower down the floricane very long and drooping at their tip. The fruiting laterals bow over each other as the harvest proceeds, are leafy but still expose and present fruit reasonably well to pickers.

Coho: cane very tall, very stout, upright in habit and produced in adequate not excessive numbers, spiny, but easy to manage and prune. Fruiting laterals are predominantly medium to long in length, very strongly attached, leafy and present fruit very well to pickers.

Cowichan: primocane upright to spreading, very tall, medium/stout, vigorous adequate in number, bear a few spines but are not unpleasant to handle are very easy to prune/train. This cultivar does not bear flowers or fruit on the tips of primocane in the late summer - autumn months. Fruiting laterals of similar length and habit as those of Glen Ample or Tulameen are leafy but mainly display the fruit well to pickers. The laterals are strongly attached and do not generally suffer damage during harvest. Fruit is easily detached from the receptacle when ripe, but like Tulameen less readily detached when under ripe.

Wei-Rula: canes very spiny, unpleasant to handle and manage, upright to spreading, tall, robust, numerous. Laterals spiny and according to position on cane, either very long (at base) or medium in length, ascending to very upright in habit, present fruit reasonably well to pickers even though they are leafy and tend to roll over each other, some breakage during harvest mainly of lateral tips which tend to be brittle.

9451D-4: spine free, very upright, stout cane produced in moderate numbers. Easy to manage, rind splits readily at bases of canes. Fruiting laterals medium to long at base of canes. All laterals very ascending in habit, strongly attached and not prone to breakage prior to or during harvest, laterals leafy multi-branched, present fruit very well to picker.

94455E-3: spine free cane, very spreading habit, pleasant to handle but difficult to manage. Moderate number and height, rind splits readily at cane base. Laterals are very short at the top but long at base of canes, ascending in habit, leafy, strongly attached and multi-branches. Present fruit reasonably well to pickers.

2000123A7: spine-free primocane, upright to slightly spreading in habit, sparse in number, medium to stout, rind splits at base of cane. Laterals medium to short in length the latter at top of canes, most ascending to held horizontal at base of cane, strongly attached and not prone to breakage during harvest. Present fruit well to pickers.

Table 52. Fruit characteristics of guard entries

Variety/Selection	Shape & size	Colour & brightness	Cohesiveness	Texture	Flavour
EM 6413/59	Blunt conic shape, evenly set, variation in berry size from large to medium through harvest	Pale-mid red, bright	Very cohesive	Fairly firm	Moderate - good
BC 89-2-89 (Esquimalt)	Round conic, evenly set, variation in berry size, generally medium to large fruit	Mid red bright, some bloom	Cohesive	Firm	Excellent sweet taste
EM 6166/98 (Malling Minerva)	Blunt conic, evenly set, small fruit	Mid-dark red, slightly hairy surface, bright	Very cohesive	Firm	Pleasant but weak flavour
BC89-33-84 (Chemainus)	Round conic, evenly set, medium to small fruit	Mid-dark red, bright, slightly dull when fully ripe	Very cohesive	Firm	Pleasant but weak flavour
BC 90-8-20	Blunt conic, some unevenness in set, large fruit throughout harvest	Very dark red when fully ripe, fairly bright	Cohesive	Firm, chewy, prominent skin	Good sweet
Rubaca	Medium to small fruit, round conic even set, neat appearance	Mid red bright, darkens and becomes dull as ripens	Cohesive	Very soft	Poor weak flavour
Kitsilano	Conical, variability in shape and size of drupes, small fruit	Mid red, some brightness	Cohesive	Firm prominent skin creates unpleasant sensation when eaten	Very poor, insipid, at times unpleasant
BC 90-8-11	Conic, evenly set, large fruit	Mid red, bright	Cohesive	Firm	Excellent sweet distinctive flavour
EM 6507/35	Round-round conic, medium sized berries, some variation in drupelet and fruit size	Pink-red	Cohesive	Firm	Weak flavour
EM 6487/74	Small, round, consistent shape, drupelet size and set	Salmon pink	Cohesive	Very soft	Weak poor flavour
9612F-2	Very large neat round conic even set and shape, top of fruit easily torn when fruit picked under-ripe	Mid red, bright glossy, large drupelets, fleshy to sometimes dry texture	Cohesive	Very firm	Good flavour
9751E-2	Small round conic, even shape	Mid- dark red when	Cohesive	Firm	Moderate

	and set, strong skin, top of fruit easily torn	fully ripe, glossy			flavour

Table 52 (continued): Fruit characteristics of guard entries

Variety/Selection	Shape & size	Colour & brightness	Cohesiveness	Texture	Flavour
BC 89-34-41 (Saanich)	Conical, medium to small in size, even set, has prominent seeds and a weak easily ruptured skin	Very dark red, some brightness but become dull when fully ripe,	Cohesive	Soft	Poor watery taste
Coho	Conical–blunt conical, medium sized, unevenly set fruit	Mid red, bright but dulls as ripens	Cohesive	Firm	Moderate to good flavour
Cowichan	Conic, uniform shape set and size throughout harvest. Large	Mid – dark red, very bright and attractive	Very cohesive	Firm	Variable generally sweet aromatic but can be a little weak
Wei-Rula	Conic, medium to small berries, evenly set, skin readily ruptured when fruit ripe	Dark red, bright	Very cohesive	Very soft	Weak, insipid, unpleasant
9451D-4	Medium to large round berries look like Glen Ample, large drupelets even set, strong skin, top of berries can be easily torn if picked under-ripe	Mid to dark red when fully ripe, glossy very attractive appearance	Very cohesive	Firm	Moderate no distinctiveness
94455E-3	Very large neat fleshy fruit blunt conic-long conic very even shape and set	Mid to dark red when fully ripe, glossy dulls slightly as ripens	Very cohesive	Firm	Good flavour
2000123A7	Large blunt conical even set and shape	Mid red very glossy berries	Cohesive	Firm	Good flavour

Susceptibility of guard entries to pest and disease

The pest and disease symptoms evident on the main entries throughout the life of the trial are described below.

EM 6413/59: Susceptible to *Phytophthora rubi,* no spur blight or cane botrytis infection observed.

BC 89-2-89 (Esquimalt): susceptible to *Phytophthora rubi*, slightly spur blight or cane botrytis infection observed.

EM 6166/98 (Malling Minerva): susceptible to *Phytophthora rubi;* no cane infections observed.

BC 89-33-84 (Chemainus): susceptible to *Phytophthora rubi,* cane botrytis and crown gall

BC 90-8-20: moderately susceptible to spur blight and susceptible to *Phytophthora rubi*, foliage in late summer susceptible to raspberry rust.

Rubaca: No *Phytophthora rubi*, moderately susceptible to spur blight.

Kitsilano: Susceptible to *Phytophthora rubi*, moderately susceptible to spur blight and cane *botrytis.*

BC 90-8-11: very susceptible to *Phytophthora rubi*, moderate susceptibility to cane *botrytis.*

EM 6507/35: very susceptible to *Phytophthora rubi*, no cane disease infection observed

EM 6487/74: susceptible to *Phytophthora rubi*, moderate spur blight infection observed

9612F-2: susceptible to *Phytophthora rubi*, no spur blight or cane botrytis observed, susceptible to raspberry rust. Rind of primocane splits at cane base in late summer.

9751E-2: susceptible to *Phytophthora rubi,* no spur blight or cane botrytis observed, susceptible to raspberry rust, rind of primocane splits readily at cane base during summer.

BC 89-34-41 (Saanich): susceptible to *Phytophthora rubi* no spur blight or cane botrytis infection observed.

EM 5928/114 (Malling Hestia): susceptible to *Phytophthora rubi,* no spur blight or cane botrytis infection observed.

Coho: low level of foliage infection by raspberry rust in the late summer/early autumn susceptible to *Phytophthora rubi* and *m*oderately susceptible to spur blight.

Cowichan: No *Phytophthora rubi* or cane disease infection observed.

Wei-Rula: no *Phytophthora rubi* observed, moderately susceptible to cane *botrytis.*

9451D-4: susceptible to *Phytophthora rubi,* no spur blight or cane botrytis observed, susceptible to raspberry rust, rind of primocane splits readily at cane base during summer.

94455E-3: susceptible to *Phytophthora rubi,* no spur blight or cane botrytis observed, susceptible to raspberry rust, rind of primocane splits readily at cane base during summer.

2000123A7: susceptible to *Phytophthora rubi,* no spur blight or cane botrytis observed, susceptible to raspberry rust, rind of primocane splits readily at cane base during summer.

Conclusions

Main entries

The following selections (now cultivars) have been identified as having considerable commercial potential:

EM6544/80 (Malling Juno) – as a replacement for Glen Moy and Glen Lyon for very early fruit production under all year round glasshouse, fixed poly tunnel or Spanish tunnel protection (Plate 1).

Plate 1. Fruit of Malling Juno (EM6544/80)

Plate 2. Fruit of Glen Fyne (9062E-1)

9062E-1 (Glen Fyne) – as a potential replacement for Tulameen and Glen Ample for early and mid-season fresh fruit production under all year round glasshouse, fixed poly tunnel and Spanish tunnel protection. This cultivar has been shown in other trials to produce fruit suitable for processing and also for machine harvesting (Plate 2).

9053B6 (Glen Doll) – as a replacement for Tulameen and Glen Ample protected at flowering or at harvest by Spanish tunnels or for unprotected open field fresh fruit production. This cultivar has been shown in other trials to produce fruit suitable for processing (Plate 3).

All the above selections have superior resistance or tolerance to pest infestation, i.e. gene A10 (resistance to strains 1-4) of the large raspberry aphid and infection by spur blight and cane and fruit botrytis when compared to the industry standard cultivars Glen Ample and Tulameen. They also offer the opportunity for growers to reduce pesticide usage and thereby to minimise residues in produce at harvest.

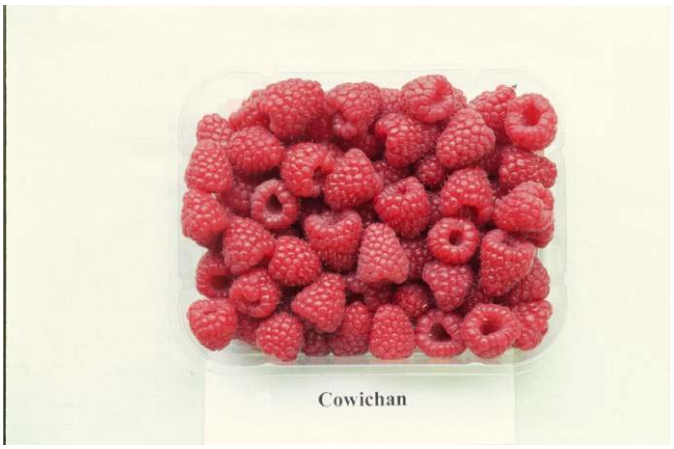
Plate 3. Fruit of Glen Doll (9053B6)

In addition, these cultivars have many agronomic characteristics which are superior to those possessed by the current industry standards e.g. cane vigour and number, spine freedom, cane habit, lateral strength, habit, presentation to and detachment of fruit by the pickers, which should enable growers an opportunity to reduce the cost of crop management and harvesting.

Guard entries

Cowichan was identified as having commercial potential in the UK, where cultivars such as Glen Ample or Tulameen have failed to perform and where low cost fruit production is envisaged. Its defining characteristics are consistently high levels of quality fruit production and robust, easily managed plants.

Plate 4. Fruit of Cowichan



Technology transfer

Results were presented to members of HDC at meetings held at the site of the trial on the 6 July 2004 and 14 July 2006 as well as at numerous presentations to UK soft fruit growers including at Ashford Soft Fruit Conference 2004, & 2005 and at British Independent Fruit Growers Conference 2006. Articles written for inclusion in HDC News, July 2004 and December 2006 issues and for inclusion in the 2007 edition of Berry Book. Factsheet 07/07 'HDC Summer fruiting raspberry variety trial' published June 2007.

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Appendix 1: Photographs of experiment site

1. View of the experiment shortly after planting in 2002.

2. View of the experiment in spring of 2004 (first fruiting year). Note plots planted with micro-propagated Tulameen or Glen Ample in late summer 2003 which were cut to the ground in January 2004. These plots just contain primocane.