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AUTHENTICATION

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

Harriet Roberts

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ADAS UK Ltd.

Signature Date 30th March 2015

Report authorised by:

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GROWER SUMMARY

Headline

- This trial is being carried out to evaluate 12 new summer fruiting (floricane) varieties and advanced selections and compare these with two current industry standards, Tulameen (NAKT clone) and Octavia.

Background

There is a continuing requirement to identify raspberry varieties for commercial production which meets the evolving needs of the market, whilst offering opportunities for profitable production to growers. This project has been established within a commercial plantation of raspberries to enable the identification of varieties and advanced selections which would offer growers:

- High yields and reliable cropping over the longest possible season
- Reduced labour costs because of less complicated cane management and a greater proportion of fruit that is readily accessible to pickers
- Fruit with an attractive appearance, good flavour, texture and shelf-life
- Potential to reduce pesticide usage as the result of improved tolerance or resistance to major pests and diseases

In combination, the above, selected traits for raspberry varieties will enable the UK industry to maintain and increase its market share, extend the harvest season and, importantly, reduce unit costs.

This trial has been designed to critically evaluate named varieties and advanced selections, sourced from two UK raspberry breeding programmes; East Malling Research (EMR) and James Hutton Institute (JHI) and four non-UK raspberry breeding programmes; Agricultural and Agri-Food Canada and Agricultural Agri-Food Canada substation in L'Acadie (PARC), Washington State University (WSU) and Graminor AS, Norway. It will offer the opportunity to appraise varieties that may soon be available to growers but for which there is currently little or no experience as to their suitability for growing in the UK or elsewhere in Europe. The trial includes two advanced selections from JHI (0485K-1 and 0019E-2) and Jeanne d' Orleans

from Agricultural and Agri-Food Canada sub-station in L'Acadie, Quebec, which as guards in AHDB Horticulture SF41c, were identified as having considerable commercial potential.

Results of the variety trials

This is a summary of the results of the variety trial to date. This report details how the plants have established and details some initial results on habit and establishment in 2014. For full and comprehensive information on these results and the pest and disease assessments, please consult the full trial report. The first harvest assessment will be carried out in 2015.

Information regarding the sources of the varieties grown and the planting date of these varieties can be found in **Table 1**.

Table 1. Details of main and guard entry cultivars, source and planting dates

Variety number	Variety	Source	Planting date 2013
1	Octavia	RW Walpole	17th June
2	Tulameen	RW Walpole	17th June
3	BC92-9-15	PARC	17th June
4	AAC Eden (KO6-2)	PARC	17th and 21st June
5	EM6803/16	EMR	12th August
6	EM6805/142	EMR	12th August
7	EM6804/68	EMR	12th August
8	EM6804/81	EMR	12th August
9	0447 C-5	JHI	18th June
10	0435 D-3	JHI	18th June
11	0485 K-1	JHI	18th June
12	0019 E-2	JHI	18th June
	Guards		
1	0015F1	JHI	18th June
2	WSU 1568	WSU	2nd July
3	Ukee	PARC	18th June
4	0658 C-5	JHI	18th June
5	Tulameen Pearl Clone 299-5	PARC	18th June
6	BC1 88-6	JHI	18th June
7	0550 E-4	JHI	18th June
8	WSU 1605	WSU	2nd July
9	Jean d'Orléans	PARC (L'Acadie, Quebec)	18th June
10	0534RB1	JHI	18th June
11	Tulameen Pearl Clone 300 -5	PARC	18th June
12	Tulameen Pearl Clone 301 -5	PARC	18th June
13	Glen Fyne	JHI	18th June
14	0460 F-5	JHI	18th June
15	WSU 1607	WSU	2nd July
16	0546H-6	JHI	2 plants failed June 2013 no plants 2014

Variety number	Variety	Source	Planting date 2013
17	0658 E-1	JHI	18th June
18	EM6804/42	EMR	12th August
19	RU004 03067	Graminor Norway	2nd July 2014
20	RU044 03073	Graminor Norway	2nd July 2014
21	RU004 04106	Graminor Norway	2nd July 2014
22	0427 G-7	JHI	22nd June 2014

*JHI – James Hutton Institute, EMR – East Malling Research, WSU – Washington State university, PARC – Pacific Agri-Food Research Centre

The trial is located at Rectory Farm, Oxford. Selected varieties were established within a commercial south facing stand of soil grown raspberries. The soil is a free draining light loamy sand. The raspberries were propagated as module raised plants and planted 0.45m apart into polythene mulch covered raised beds with trickle irrigation. The main entries were replicated four times with 10 plants apportioned to each plot. Guard entries are single un-replicated 10 plant plots of each variety.

All of the main and the majority of the guard entries were planted as the planting material became available in June, July and August 2013. Three numbered selections namely 0427G (from the James Hutton Institute), RU004 03067, RU044 03073 and RU004 04106 from the Norwegian raspberry breeding programme Graminor and a single plot of the main entry EM6803/16 from East Malling Research, were planted in July 2014. The latter selection was planted to check that the plants planted in the main trial were true to type. As in 2013 all the additional planting material was supplied as module raised plants.

The plants supplied in 2013 established a large root system and in the majority of cases, reasonable amounts of primocane growth during the year of planting. However so as to ensure that all plants are as even in growth as possible and that their first harvest would be as fully cropping plants, all of the primocane was removed (cut out at ground level) in mid-February 2014.

The first flush of primocane produced by these cut back plants was thinned by hand down to 3-4 per plant in late May and then again in early August 2014. A further thinning of the canes was made in September-early October 2014 so as to leave approximately 3 canes/plant or 6 floricane per linear run of crop row to crop in 2015.

Figure 1. Images of the trial site: left June 2014, right: September 2014

Four assessments were carried out in 2014/15, to measure plant growth, growth habit and any incidence of pests or disease. Table 2 details the results of the assessment carried out on February 7th 2014. Bud condition gives a suggestion of earliness (i.e. those with green bud in February such as EM6803/16, EM6804/68 and 0447C-5 are likely to be the earlier selections). The data also indicate how much growth the canes achieved in their first growing season.

Table 2. Results of plant assessments in February 2014

Varieties		Spines (1) Spine free (0)	Average of Height of canes 1=0-30cm, 2=30-60cm, 3=60-100cm, 4=100cm +	Average of Bud condition: 1 = dormant, 2= green,	Average of disease Y=1, N=0
1	Octavia	1	4.00	1.25	0
2	Tulameen	1	4.00	1.75	0
3	BC92-9-15	1	4.00	1.00	0
4	AAC Eden (KO6-2)	0	4.00	1.50	0
5	EM6803/16	1	1.50	2.00	0
6	EM6805/142	0	2.00	1.00	0
7	EM6804/68	1	1.75	2.00	0
8	EM6804/81	1	1.75	1.50	0
9	0447C-5	0	4.00	2.00	0
10	0435D-3	0	3.50	1.75	0
11	0485K-1	0	1.50	1.00	0
12	0019E2	0	1.75	1.25	0
			Guard Entries		
1	0015F1	0	1.00	2.00	0
2	WSU 1568	1	1.00	2.00	0
3	Ukee	1	4.00	2.00	0
4	0658 C-5	0	4.00	1.00	0
5	Tulameen Pearl Clone 299-5	1	4.00	2.00	0
6	BC1 88-6	1	4.00	1.00	0
7	0550E-4	0	2.00	1.00	0
8	WSU 1605	1	2.00	2.00	0

Varieties		Spines (1) Spine free (0)	Average of Height of canes 1=0-30cm, 2=30-60cm, 3=60-100cm, 4=100cm +	Average of Bud condition: 1 = dormant, 2= green,	Average of disease Y=1, N=0
9	Jean d'Orléans	1	4.00	2.00	0
10	0534RB1	0	3.00	2.00	0
11	Tulameen Pearl Clone 300 -5	1	3.00	2.00	0
12	Tulameen Pearl Clone 301 - 5	1	2.00	2.00	0
13	Glen Fyne	0	3.00	1.00	0
14	0460F-5	0	2.00	1.00	0
15	WSU 1607	1	2.00	2.00	0
17	0658E-1	0	1.00	1.00	0
18	EM6804/42	1	3.00	1.00	0

Table 3 shows the results of the assessment carried out on 15 and 22 January 2015 including cane height, diameter and numbers of floricane per plot.

Table 3. Results of plant assessments in January 2015

Varieties		No of plants/plot	Average height of canes* 1=tall 2=medium 3=short	Cane diameter 1=Stout 2=average 3=thin	Average floricane number/ plant
1	Octavia	10	1	2	2.2
2	Tulameen	10	1	1-2	2.9
3	BC92-9-15	10	1	2	2.9
4	AAC Eden (KO6-2)	10	1	1	2.8
5	EM6803/16*	10	3	3	1.8
6	EM6805/142	10	1	1-2	2.2
7	EM6804/68	10	1	1-2	2.5
8	EM6804/81	10	1	1-2	2.5
9	0447C-5	10	1	1-2	3.0
10	0435D-3	10	1	1-2	2.8
11	0485K-1	10	1	2-1	2.7
12	0019E2	10	1	1	2.5
			Guard Entries		
1	0015F1	10	1	2	2.2
2	WSU 1568	10	1	1	3.0
3	Ukee	10	1	2	3.1
4	0658 C-5	10	1	2	3.0
5	Tulameen Pearl 299-5	6	1	1	3.1
6	BC1-88-6*	4	1	1	3.5
7	0550E-4	10	1-2	2	2.2
8	WSU 1605	10	1	1	3.1
9	Jean d'Orléans	10	1	2	3.2
10	0534RB1	10	1	1-2	3.3
11	Tulameen Pearl 300 -5	6	1	1	3.0

Varieties		No of plants/plot	Average height of canes* 1=tall 2=medium 3=short	Cane diameter 1=Stout 2=average 3=thin	Average floricane number/ plant
12	Tulameen Pearl 301 - 5	3	1	1	2.7
13	Glen Fyne	10	1-2	2	2.8
14	0460F-5	10	1	1	2.9
15	WSU 1607	10	1	1	3.0
17	0658E-1	7+3**	1-2	2-3	2.6
18	EM6804/42	10	1-2	2	3.0

*BC1-88-6 plot also contains 6 rogue plants of a primocane fruiting selection
** 3 plants re-planted in 2014
Selections from Norwegian raspberry breeding programme Graminor and a single plot of the main entry EM6803/16 not included as planted in 2014

Main conclusions

Canes of both the main selection and guard entries have established well in these first two years. Many of the varieties such as the selections from WSU are displaying desirable traits which include the production of adequate but not excessive numbers of cane, which are easy to thin, are tall, very upright in habit and with numerous nodes. EM6804/68 had a spreading habit but all other entries showed upright to upright-spreading primocane habit. Some pests were present when the plants were assessed in July 2014 along with some infection of floricane by spur blight and or cane *Botrytis* in February 2015. Botrytis in particular appeared to be affecting all the clones of Tulameen. At this stage it is impossible to determine whether or not these findings will have an adverse effect upon yield. Further assessments will be needed to determine this. Splitting in some cases from the bottom to half way up the height of floricane was recorded affecting Tulameen and the entries from WSU.

The first harvest will be taken in 2015 and records will be made in 2015 and 2016 of yield, berry weight, fruit quality characteristics such as size, colour, firmness and shelf-life. In 2015 and 2016 the plant characteristics of all the entries will also be evaluated including plant habit, date of bud break, evenness of bud break, ease of management, lateral pose, strength of attachment, ease of fruit detachment and pest and disease susceptibility.

FULL TRIAL REPORT

Introduction

There is a continuous requirement to identify new raspberry cultivars for commercial production which meet the ever changing needs of the market, whilst offering opportunities for profitable production to growers. This trial has been commissioned in order to identify new cultivars and advanced selections which will offer UK producers of raspberries the following criteria:

- Higher yields than the current industry standards;
- Superior quality fruit (size, uniformity of shape, colour, texture, flavour and a long shelf life);
- Present fruit well to pickers, on strongly attached laterals, ideally do not require support, with fruit which is readily detached, making it cheap to harvest;
- Plants with adequate vigour and primocane production for growing in soil or in substrate, with a good upright cane habit, making them easy and cheap to grow;
- Plants that will offer better tolerance to winter and spring cold injury;
- Pest and disease tolerance or resistance.

The aim of the project is therefore to evaluate and identify cultivars and advanced selections from UK and other breeding programmes to be utilised by UK growers to either replace or extend the harvest period of current industry standard cultivars for fresh fruit production.

Materials and methods

Cultivars and numbered selections included

This trial examines cultivars and advanced selections sourced from two UK raspberry breeding programmes; East Malling Research (EMR) and James Hutton Institute (JHI) and four non-UK raspberry breeding programmes; Agricultural and Agri-Food Canada and Agricultural Agri-Food Canada substation in L'Acadie (PARC), Washington State University (WSU) and Graminor AS, Norway. It offers the opportunity to appraise cultivars that may be available soon to growers and for which there is little or no experience as to their suitability for growing in the UK or elsewhere in Europe. The trial also includes two advanced selections from JHI i.e. 0485K-1 and 0019E-2 and Jeanne d' Orleans from Agricultural and Agri-Food Canada sub-station in L'Acadie, Quebec which as guards in AHDB Horticulture

SF41c were identified as having considerable commercial potential. These are detailed in Table 4.

Table 4. Details of guard and main entry cultivars, source and planting dates

Cultivar number	Cultivar	Source	Planting date 2013
1	Octavia	RW Walpole	17 June
2	Tulameen	RW Walpole	17 June
3	BC92-9-15	PARC	17 June
4	AAC Eden (KO6-2)	PARC	17 and 21 June
5	EM6803/16	EMR	12 August
6	EM6805/142	EMR	12 August
7	EM6804/68	EMR	12 August
8	EM6804/81	EMR	12 August
9	0447 C-5	JHI	18 June
10	0435 D-3	JHI	18 June
11	0485 K-1	JHI	18 June
12	0019 E-2	JHI	18 June
	Guards		
1	0015F1	JHI	18 June
2	WSU 1568	WSU	2 July
3	Ukee	PARC	18 June
4	0658 C-5	JHI	18 June
5	Tulameen Pearl Clone 299-5	PARC	18 June
6	BC1 88-6	JHI	18 June
7	0550 E-4	JHI	18 June
8	WSU 1605	WSU	2 July
9	Jean d'Orléans	PARC (L'Acadie, Quebec)	18 June
10	0534RB1	JHI	18 June
11	Tulameen Pearl Clone 300 -5	PARC	18 June
12	Tulameen Pearl Clone 301 -5	PARC	18 June
13	Glen Fyne	JHI	18 June
14	0460 F-5	JHI	18une
15	WSU 1607	WSU	2nd July
16	0546H-6	JHI	2 plants failed June 2013 no plants 2014
17	0658 E-1	JHI	18 June
18	EM6804/42	EMR	12 August
19	RU004 03067	Graminor Norway	2 July 2014
20	RU044 03073	Graminor Norway	2 July 2014
21	RU004 04106	Graminor Norway	2 July 2014
22	0427 G-7	JHI	22 June 2014

*JHI – James Hutton Institute, EMR – East Malling Research, WSU – Washington State university, PARC – Pacific Agri-Food Research Centre

Trial site details

The trial was planted in soil at Rectory Farm, Stanton St John, Oxford OX33 1HF. Located

within a commercial south facing planting of raspberries with a free draining a light loamy sand soil.

Production details

All of the main and the majority of the guard entries were planted as the planting material became available in June, July and August 2013. Three numbered selections, namely 0427G (from the James Hutton Institute), RU004 03067, RU044 03073 and RU004 04106 from the Norwegian raspberry breeding programme Graminor and a single plot of the main entry EM6803/16 from East Malling Research, were planted in July 2014. The latter to check that the plants of this selection supplied and planted in the main trial were true to type. As in 2013 all the additional planting material was supplied as module raised plants and all the plants for this trial were supplied as virus indexed and/or PHPS certified module raised plants grown from root cuttings.

All the plants were supplied with trickle irrigation and fertigated from planting onwards. At planting no support trellis was in position, however this was installed in early spring of 2014, so that the primocane of all the entries could be supported.

The plants supplied in 2013 established a large root system and, in the majority of cases, reasonable amounts of primocane growth during the year of planting. However so as to ensure that all plants are as even in growth as possible and that their first harvest would be as fully cropping plants, all of the primocane was removed (cut out at ground level) of the 2013 planted plots whilst the canes were fully dormant in mid February 2014.

The first flush of primocane produced by these cut-back plants was thinned by hand down to 3-4 canes per plant in late May and then again in early August 2014. A further thinning of the canes was made in September-early October 2014 so as to leave approximately 2.5-3 canes/plant or 5.5-6.6 floricane per linear run of crop row to crop in 2015.

Pest, disease, weed control and the nutrition of the trial since planting has been as per required for the trial plants and since spring 2014 dictated by the requirements of the commercial planting of raspberries that surrounds it, advised by BASIS and FACTS qualified agronomist Janet Allen.

Trial design

The main part of the trial was set up as a randomised block design with 12 cultivars which were replicated four times with 10 plants in each plot (**Appendix 1**). The guard entry plots

consisted of unreplicated 10 plant plots. The raspberries were planted 0.45m apart into poly-mulch covered raised soil beds with 2.4m between the crop rows, and a 1 m wide plant free gap between each plot.

Cultivars were planted so that they could be protected in the cropping years with two Spanish tunnels. Each tunnel will contain two rows of raspberries, each row contains a replicate of each main entry and of the standard cultivars.

Guard entries were planted in an adjacent three row tunnel in two rows with the same spacing as described above.

Trial records and data collected

Four assessments were made during 2014/2015 on 7 February, 2 July 2014, 15 - 22 January 2015 and February 2015. These were carried out to identify the characteristics of the primocane of the trial entries planted in 2013 i.e. height, thickness, vigour, disease and pest susceptibility and growth habit.

Table 5 details the results of the assessment carried out on 7 February 2014, it shows that no disease was observed on any of the selections. Bud condition gives a suggestion of earliness i.e. those with green bud in February (such as EM6803/16, EM6804/68 and 0447C-5) were likely to be the earlier selections. It also shows how much growth the canes achieved in their first growing season (planting year). BC92-9-15, AAC Eden (KO6-2), 0447C-5, Ukee, 0568C, Tulameen Pearl Clone 299-5, BC1-88-6 and Jean d'Orléans all achieved similar levels of growth to the standards Octavia and Tulameen, producing floricane over 1 m in height.

The poor cane growth of the EMR entries was primarily due to their late planting. However in the majority of the plots the plants in all of the plots planted in 2013 had extensive root systems by February 2014, including those which had produced few canes or ones of poor stature in the planting year.

It was too early to determine cane habit or other growth characteristics of the entries in February 2014.

Table 5. Results of plant assessment February 2014

Cultivars		Spines (1) Spine free (0)	Average of height of canes 1=0-30cm, 2=30-60cm, 3=60-100cm, 4=100cm +	Average of bud condition: 1 = dormant, 2= green,	Average of disease Y=1, N=0
1	Octavia	1	4.00	1.25	0
2	Tulameen	1	4.00	1.75	0
3	BC92-9-15	1	4.00	1.00	0
4	AAC Eden (KO6-2)	0	4.00	1.50	0
5	EM6803/16	1	1.50	2.00	0
6	EM6805/142	0	2.00	1.00	0
7	EM6804/68	1	1.75	2.00	0
8	EM6804/81	1	1.75	1.50	0
9	0447C-5	0	4.00	2.00	0
10	0435D-3	0	3.50	1.75	0
11	0485K-1	0	1.50	1.00	0
12	0019E2	0	1.75	1.25	0
	Guard entries				
1	0015F1	0	1.00	2.00	0
2	WSU 1568	1	1.00	2.00	0
3	Ukee	1	4.00	2.00	0
4	0658 C-5	0	4.00	1.00	0
5	Tulameen Pearl Clone 299-5	1	4.00	2.00	0
6	BC1 88-6	1	4.00	1.00	0
7	0550E-4	0	2.00	1.00	0
8	WSU 1605	1	2.00	2.00	0
9	Jean d'Orléans	1	4.00	2.00	0
10	0534RB1	0	3.00	2.00	0
11	Tulameen Pearl Clone 300 -5	1	3.00	2.00	0
12	Tulameen Pearl Clone 301 - 5	1	2.00	2.00	0
13	Glen Fyne	0	3.00	1.00	0
14	0460F-5	0	2.00	1.00	0
15	WSU 1607	1	2.00	2.00	0
17	0658E-1	0	1.00	1.00	0
18	EM6804/42	1	3.00	1.00	0

Table 6 details the results of the assessment carried out on 2 July 2014. In the case of the main entries in addition to Octavia and Tulameen, the primocane of EM6803/16, EM6804/68, EM6804/81 and BC92-9-15 bore noticeable spines, which could be detected along their full length.

Of the guards the three selections from Washington State University the Pearl clones of Tulameen, Ukee, Jeanne d'Orléans and EM6864/42) all had primocane which were heavily spined from bottom to tip, most particularly the WSU entries. BC92-9-15, AAC Eden, EM6805/142, EM6804/81, 0435D-3 and 0019E2 had an upright habit. EM6804/68 was noticeably spreading and all other main entries an upright to spreading primocane growth habit.

The three guard entries from WSU had a very stiff upright cane, those of 0015F1, 0550E-4, 0460F-5 and Jeanne d'Orléans were also upright in habit and all other entries appraised upright to spreading in growth.

No disease was found affecting the foliage of any of the entries, however light infestations of two spotted spider mite and or large raspberry aphid were identified on the foliage of all the entries, common green capsid, caterpillars and small raspberry sawfly were also found on a few leaves. Large raspberry aphid was found on selections which had A10 resistance to the four common strains of this pest, which is not unusual on this site. Based on these findings an acaricide and insecticide were applied to bring both pests under control, to the extent that nether became a problem for the remainder or the summer or into the autumn of 2014.

Table 6. Results of plant assessment July 2014

Cultivars		Spines (1) Spine free (0)	Position of spines on canes	Primocane habit
1	Octavia	1	Full height	Upright-spread
2	Tulameen	1	Full height	Upright-spread
3	BC92-9-15	1	Full height	Upright
4	AAC Eden (KO6-2)	0	-	Upright
5	EM6803/16	1	Full height	Upright-spread
6	EM6805/142	0	-	Upright
7	EM6804/68	1	Full height	Spreading
8	EM6804/81	1	Full height	Upright
9	0447C-5	0	-	Upright-spread
10	0435D-3	0	-	Upright
11	0485K-1	0	-	Upright-spread
12	0019E2	0	-	Upright
	Guard entries			
1	0015F1	0	-	Upright
2	WSU 1568	1	Full height	Upright
3	Ukee	1	Full height	Upright-spread
4	0658 C-5	0	-	Upright-spread
5	Tulameen Pearl Clone 299-5	1	Full height	Upright
6	BC1-88-6	1	Full height	Upright-spread

Cultivars		Spines (1) Spine free (0)	Position of spines on canes	Primocane habit
7	0550E-4	0	-	Upright
8	WSU 1605	1	Full height	Upright
9	Jean d'Orléans	1	Full height	Upright
10	0534RB1	0	-	Upright-spread
11	Tulameen Pearl Clone 300 -5	1	Full height	Upright
12	Tulameen Pearl Clone 301 - 5	1	Full height	Upright
13	Glen Fyne	0	-	Upright-spread
14	0460F-5	0	-	Upright
15	WSU 1607	1	Full height	Upright
17	0658E-1	0	-	Upright-spread
18	EM6804/42	1	Full height	Upright-spread

The crop assessment carried out on 15 and 22 January 2015 shows the average height achieved by each of the selections the cane diameter and the average number of floricane per plant which will crop in 2015 (Table 7). It should be noted that selections from the Norwegian raspberry breeding programme, Graminor, and a single plot of the main entry EM6803/16 were not included as these were planted in 2014.

All selections achieved an adequate average height, with the exception of EM6803/16. This selection however appears not to be true to type, producing thin highly branched cane with crinkled leaves. Cane thickness was good for the majority of entries, but most particularly for all clones of Tulameen and also the advanced selections from the PARC and WSU breeding programmes, which all produced very tall and stout canes. There was some variation in floricane number between cultivars. Of the main entries the lowest number 1.8 canes/plant was for the plants of EM6803/16 displaying abnormal growth characteristics. The highest at 3.0 canes/plant was for the JHI advanced selection 0447C-5. All the others had at least 2 canes/plant and most 2.5 or more canes/plant. Of the guard entries BC 1-88-6 had the highest at 3.5 canes/plant and 0015F1 and 0550E-4 the lowest at 2.2 canes/plant. All the other guards had at least 2.5 canes/plant and Tulameen Pearl clones 299-5 and 300-5, WSU 1568, 1605 and 1607, Ukee, JHI 0658C-5, 0534RB1, EM6804/42 and Jean d'Orléans 3 or more canes/plant.

Table 7. Results of plant growth assessments carried out in January 2015

Cultivars		No of plants/plot	Average height of canes* 1=tall 2=medium 3=short	Cane diameter 1=Stout 2=average 3=thin	Average floricane number/ plant
1	Octavia	10	1	2	2.2
2	Tulameen	10	1	1-2	2.9
3	BC92-9-15	10	1	2	2.9
4	AAC Eden (KO6-2)	10	1	1	2.8
5	EM6803/16*	10	3	3	1.8
6	EM6805/142	10	1	1-2	2.2
7	EM6804/68	10	1	1-2	2.5
8	EM6804/81	10	1	1-2	2.5
9	0447C-5	10	1	1-2	3.0
10	0435D-3	10	1	1-2	2.8
11	0485K-1	10	1	2-1	2.7
12	0019E2	10	1	1	2.5
			Guard entries		
1	0015F1	10	1	2	2.2
2	WSU 1568	10	1	1	3.0
3	Ukee	10	1	2	3.1
4	0658 C-5	10	1	2	3.0
5	Tulameen Pearl 299-5	6	1	1	3.1
6	BC1-88-6*	4	1	1	3.5
7	0550E-4	10	1-2	2	2.2
8	WSU 1605	10	1	1	3.1
9	Jean d'Orléans	10	1	2	3.2
10	0534RB1	10	1	1-2	3.3
11	Tulameen Pearl 300-5	6	1	1	3.0
12	Tulameen Pearl 301-5	3	1	1	2.7
13	Glen Fyne	10	1-2	2	2.8
14	0460F-5	10	1	1	2.9
15	WSU 1607	10	1	1	3.0
17	0658E-1	7+3**	1-2	2-3	2.6
18	EM6804/42	10	1-2	2	3.0

*BC1-88-6 plot also contains 6 rogue plants of a primocane fruiting selection
** 3 plants re-planted in 2014

No cane blight, or cane spot was detected in the trial. Spur blight and cane botrytis were detected on all selections, ranging between 10-30% infection, with Tulameen, EM6804/68 and EM6804/81 showing a slightly higher level of infection than the other cultivars (Table 8).

In all cases splitting was confined to outer oldest rind of cane, and no patch lesions produced by the feeding of the larvae of raspberry cane midge or other damage to underlying suberized rind or vascular tissue were observed. Of the main entries 0485K-1 showed the least splitting, with Tulameen and EM6803/16, Ukee, 0658C-5, BC1-88-6, all the WSU selections, Jean d'Orléans, 0534RB1 and EM6804/42 showing moderate levels of splitting of rind from the bottom to a quarter or even one third of the way up the height of canes.

Table 5. Assessment of cane disease and rind splitting – February 2015

Cultivars		Level of disease infection 1 = low level of infection of all canes 0-10% of canes affected with a few disease lesions 10 = 90-100% canes displaying a high level of disease infection				Splitting of rind 1=none 10=severe
		Spur blight	Cane blight	Cane botrytis	Cane spot	
1	Octavia	1.5	0.0	2.0	0.0	2.5
2	Tulameen	3.0	0.0	2.8	0.0	4.0
3	BC92-9-15	1.5	0.0	1.3	0.0	2.3
4	AAC Eden (KO6-2)	1.5	0.0	1.0	0.0	3.5
5	EM6803/16*	1.3	0.0	2.0	0.0	4.0
6	EM6805/142	1.8	0.0	0.8	0.0	2.8
7	EM6804/68	2.8	0.0	3.0	0.0	3.8
8	EM6804/81	2.0	0.0	2.0	0.0	3.8
9	0447C-5	1.8	0.0	1.3	0.0	3.0
10	0435D-3	1.5	0.0	1.3	0.0	3.3
11	0485K-1	1.0	0.0	1.0	0.0	1.5
12	0019E2	1.5	0.0	1.0	0.0	3.0
	Guard entries					
1	0015F1	1.0	0.0	1.0	0.0	2.0
2	WSU 1568	4.0	0.0	1.0	0.0	4.0
3	Ukee	1.0	0.0	1.0	0.0	1.0
4	0658 C-5	3.0	0.0	1.0	0.0	4.0
5	Tulameen Pearl 299-5	3.0	0.0	3.0	0.0	5.0
6	BC1-88-6*	2.0	0.0	1.0	0.0	4.0
7	0550E-4	2.0	0.0	1.0	0.0	3.0
8	WSU 1605	2.0	0.0	3.0	0.0	4.0
9	Jean d'Orléans	2.0	0.0	1.0	0.0	4.0
10	0534RB1	2.0	0.0	1.0	0.0	4.0
11	Tulameen Pearl 300 -5	4.0	0.0	3.0	0.0	5.0
12	Tulameen Pearl 301 - 5	4.0	0.0	3.0	0.0	5.0
13	Glen Fyne	2.0	0.0	1.0	0.0	3.0
14	0460F-5	2.0	0.0	2.0	0.0	4.0
15	WSU 1607	3.0	0.0	2.0	0.0	4.0
17	0658E-1	2.0	0.0	1.0	0.0	3.0
18	EM6804/42	2.0	0.0	1.0	0.0	3.0

* Off type plants in plot, only true to type plants scored

Discussion

A raspberry cane with an upright growth habit is preferable as this makes them easy to support and cheap to grow. Therefore, any cultivars with a score of 1 for growth habit are desirable. The cultivars in the main part of the trial with an upright growth habit were BC92-9-15, AAC Eden (KO6-2), EM6805/142, EM6804/81, 0435 D-3 and 0019 E-2. The cultivars from the Guards which exhibited upright growth habits included 0015F1, WSU 1568, Tulameen Pearl Clone 299-5, 0550 E-4, WSU 1605, Jean d'Orléans, Tulameen Pearl Clone 300 -5, Tulameen Pearl Clone 301 -5, 0460 F-5 and WSU 1607. Cultivars with an upright-spreading or spreading habit could still be considered desirable if they offer other beneficial traits e.g. spine free canes, high pest and disease resistance, stout short or medium length self-supporting fruiting laterals, but these will require more primocane and floricane training (management) and a more sophisticated support trellis to keep them upright to present fruit well to pickers.

Pests were found at low levels on foliage of most entries when plant assessments were carried out in July 2014. This included the large raspberry aphid found on the majority of entries, including on foliage of those with A10 resistance to the four common strains of this pest. Two spotted spider mite, leaf hopper, caterpillar and sawfly were also found. The presence of pests could indicate that certain cultivars are more susceptible to certain pests, however this is hard to be sure of with the very low level pest infestation observed at this stage and will only be determined by further assessments.

In the main, disease levels were low, with no cane spot of cane blight infection found. Moderate levels of floricane infection by spur blight were recorded for the floricane of the Tulameen in the main trial and all of the Pearl Clones planted as guards, EM6804/68 and WSU1605.

No splitting of the rind of floricane was recorded for 0485K-1 or Ukee. All the Tulameen clones displayed moderate levels of splitting up to in some cases from the bottom to the middle of the affected canes as were those of the WSU entries.

Conclusions

Many of the cultivars displayed desirable traits, such as an upright growth habit and well-spaced internodes and look likely to produce fruit on the full height of the cane. Whilst some

pests were present, it is difficult to determine whether or not these are affecting certain cultivars more than others at this stage in the trial, further assessments are needed to determine this. The fact that little disease is present at this point in the trial is promising. Assessments in 2015 will continue to monitor for the presence of pests and disease along with further measures of habit, lateral growth and fruit presentation as the plants come into their first cropping year. Harvest assessments will reveal more about the quality of the fruit for the different entries and therefore their commercial potential.

Technology transfer

A summary document is being prepared for each cultivar, detailing its parentage and collating all information already available on each of the selections. This will be updated as more information is gathered through the life of this trial and will be available on the AHDB Horticulture website.

An open day at the trial site will be organised during harvest 2015 and 2016, giving AHDB Horticulture levy payers a chance to view the selections and sample fruit.

Appendix 1

	Block 1	Tunnel 2
Plot	Treat	Cultivar
1	9	0447C-5
2	3	BC92-9-15
3	8	EM6804/81
4	4	AAC Eden (KO6-2)
5	10	0435D-3
6	11	0485K-1
7	5	EM6803/16
8	2	Tulameen
9	1	Octavia
10	7	EM6804/68
11	12	0019 E2
12	6	EM6805/142

	Block 2	Tunnel 2
Plot	Treat	Cultivar
13	11	0485K-1
14	8	EM6804/81
15	12	0019 E2
16	10	0435D-3
17	3	BC92-9-15
18	5	EM6803/16
19	7	EM6804/68
20	9	0447C-5
21	6	EM6805/142
22	1	Octavia
23	4	AAC Eden (KO6-2)
24	2	Tulameen

	Block 3	Tunnel 3
Plot	Treat	Cultivar
25	1	Octavia
26	10	0435D-3
27	6	EM6805/142
28	7	EM6804/68
29	11	0485K-1
30	3	BC92-9-15
31	5	EM6803/16
32	12	0019 E2
33	9	0447C-5
34	2	Tulameen
35	8	EM6804/81
36	4	AAC Eden (KO6-2)

	Block 4	Tunnel 3
Plot	Treat	Cultivar
37	7	EM6804/68
38	2	Tulameen
39	4	AAC Eden (KO6-2)
40	8	EM6804/81
41	10	0435D-3
42	1	Octavia
43	9	0447C-5
44	6	EM6805/142
45	12	0019 E2
46	3	BC92-9-15
47	11	0485K-1
48	5	EM6803/16

Guards		Tunnel 4		
	Row 1	Row 2		Row 3
1	0015F1	8	0550 E-4	15	Glen Fyne
2	WSU 1568	9	WSU 1605	16	0460 F-5
3	Ukee	10	Jean d'Orleans	17	WSU 1607
4	0658 C-5	11	0534RB1	18	0427 G-7
5	Tulameen Pearl clone 299-5 (6 plants)	12	Tulameen Pearl clone 300-5 (6 plants)	19	0658 E-1
6	BC1-88-6	13	Tulameen Pearl clone 301-5 (2 plants)	20	EM6804/42
7	RU0043067	14	RU04403073	21	RU04106