



New developments in the Scottish raspberry breeding programme

Nikki Jennings*

Lynne Ferguson*

Rex Brennan**

Mylnefield Research Services Ltd*

Scottish Crop Research Institute**

Invergowrie,

Scotland

DD2 5DA



SSCR Soft Fruit meeting, Wednesday 17th February 2010

Raspberry breeding at SCRI



- Breeding began in 1950s
- Renowned for the “Glen” series of raspberry cultivars
- Focused on Scottish industry and processing for several years
- Scottish Soft Fruit Growers 1993-2000
- Current focus on UK industry and fresh market
- Scottish Raspberry Breeding Consortium 2002-2009
- UK Raspberry Breeding Consortium 2009-2014



Scottish Raspberry Breeding Programme 2002-2009



- Funded by the Scottish Raspberry Breeding Consortium
- Transition from processing to fresh market
- Two summer-fruiting cultivars released
- 15 advanced selections identified for on-farm trials
- Further two genotypes with strong tolerance to *Phytophthora*, one identified for release
- Development of underpinning science at SCRI

Glen Doll



- Mid-late season
- Sweet raspberry flavour
- Excellent fruit quality and shelf-life
- Good tolerance to cane diseases
- Higher tolerance to *Phytophthora* root rot than Glen Ample
- RBDV free in SCRI plots
- Concern over fruit size and propagation stock

Glen Fyne



- Mid season
- More productive than Glen Ample at SCRI
- Superb sweet raspberry flavour
- Large fruit with good shelf life
- Harvests well by machine
- Susceptible to *Phytophthora* root rot

Key selections at SCRI: *Phytophthora* tolerant genotype for processing



99111B2

- Large meaty fruit
- Good quality
- High Brix and good aroma but poor fresh flavour, v acid
- Very upright cane habit
- Harvests well by machine
- Free of RBDV in SCRI plots thus far
- PVR applied for in 2008



Advanced selections planted on-farm 2005/06



99111B2

Processing, high
Phytophthora
tolerance



00123A7
good quality



9764F-3
large size



9455F-2
large size

SCRI Selections: Mean SCRI data 2007-09



	Mean fruit size (g)	Mean brix %
9764F-3	5.6	9.0
9455F-2	7.2	8.5
99111B2	4.9	9.6
00123A7	5.3	11.2
Glen Fyne	5.2	10.7
Glen Doll	4.9	9.7
Octavia	6.0	9.1
Glen Ample	5.5	9.2
Tulameen	3.9	11.2

Advanced selections planted on-farm 2007/08



9350F3
good quality



0019E2 late



9911C-1 early



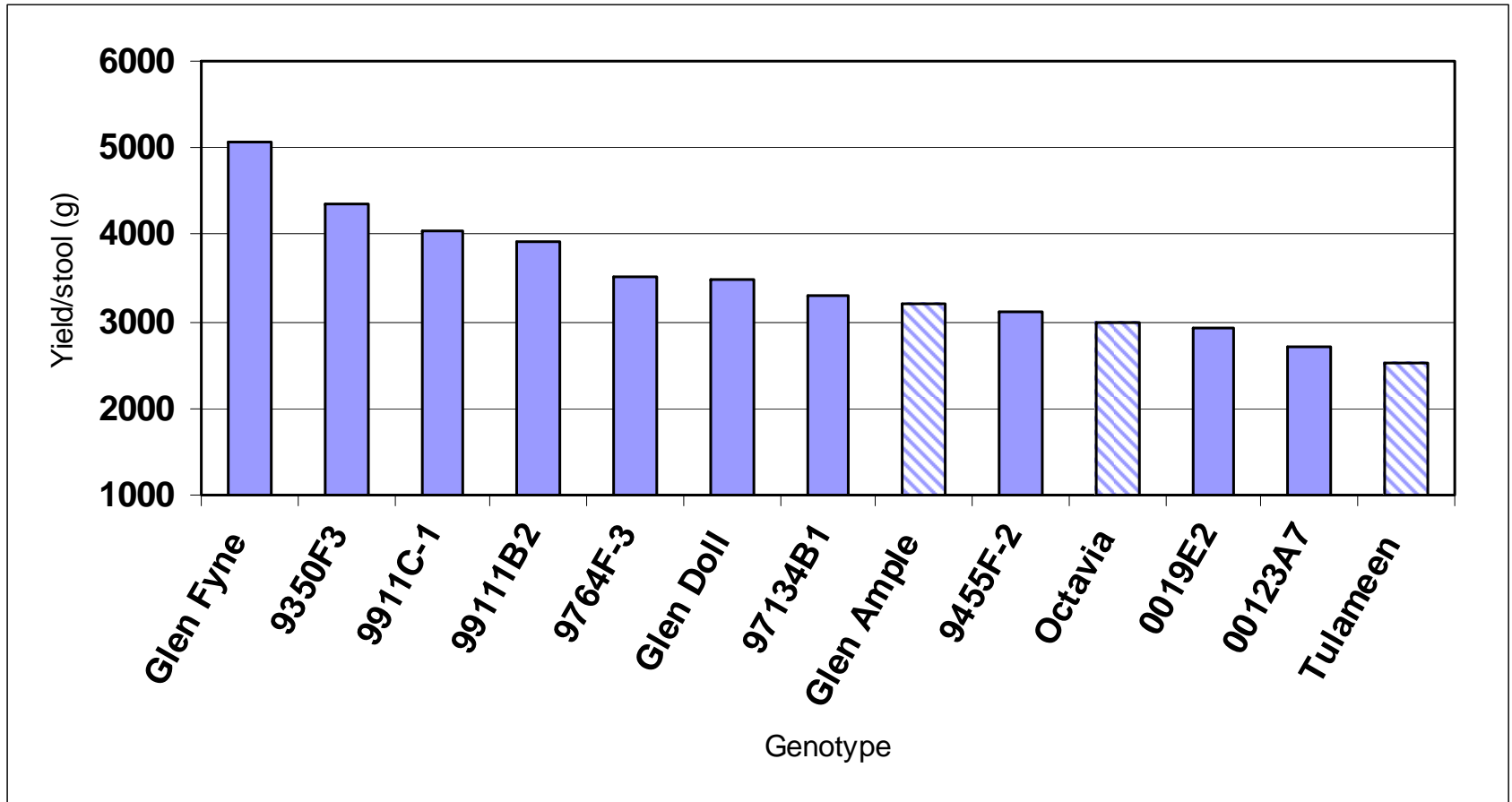
97134B1
yellow

SCRI Selections: Mean SCRI data 2007-09



	Mean fruit size (g)	Mean brix %
9911C-1	5.9	10.5
0019E2	7.4	9.2
9350F3	5.0	9.3
97134B1	4.9	9.1
Glen Fyne	5.2	10.7
Glen Doll	4.9	9.7
Octavia	6.0	9.1
Glen Ample	5.5	9.2
Tulameen	3.9	11.2

SCRI Mean yield data 2007-2009



New raspberry selections 2009



0453C4

- Very early season
- Glossy attractive fruit with sweet raspberry flavour
- Fruit size: 4.4g
- Brix: 10.6%
- Yield: 3434g/stool



0433F2

- Early season
- Glossy and conical, v similar to Tulameen
- Fruit size: 5.0g
- Brix: 10.3%
- Yield: 1932.5g/stool



0304F6

- Mid-late season
- Large meaty pale fruit
- Strong flavour, sweet with a sharp edge
- Fruit size: 5.4g
- Brix: 9.7%
- Yield: 3835g/stool

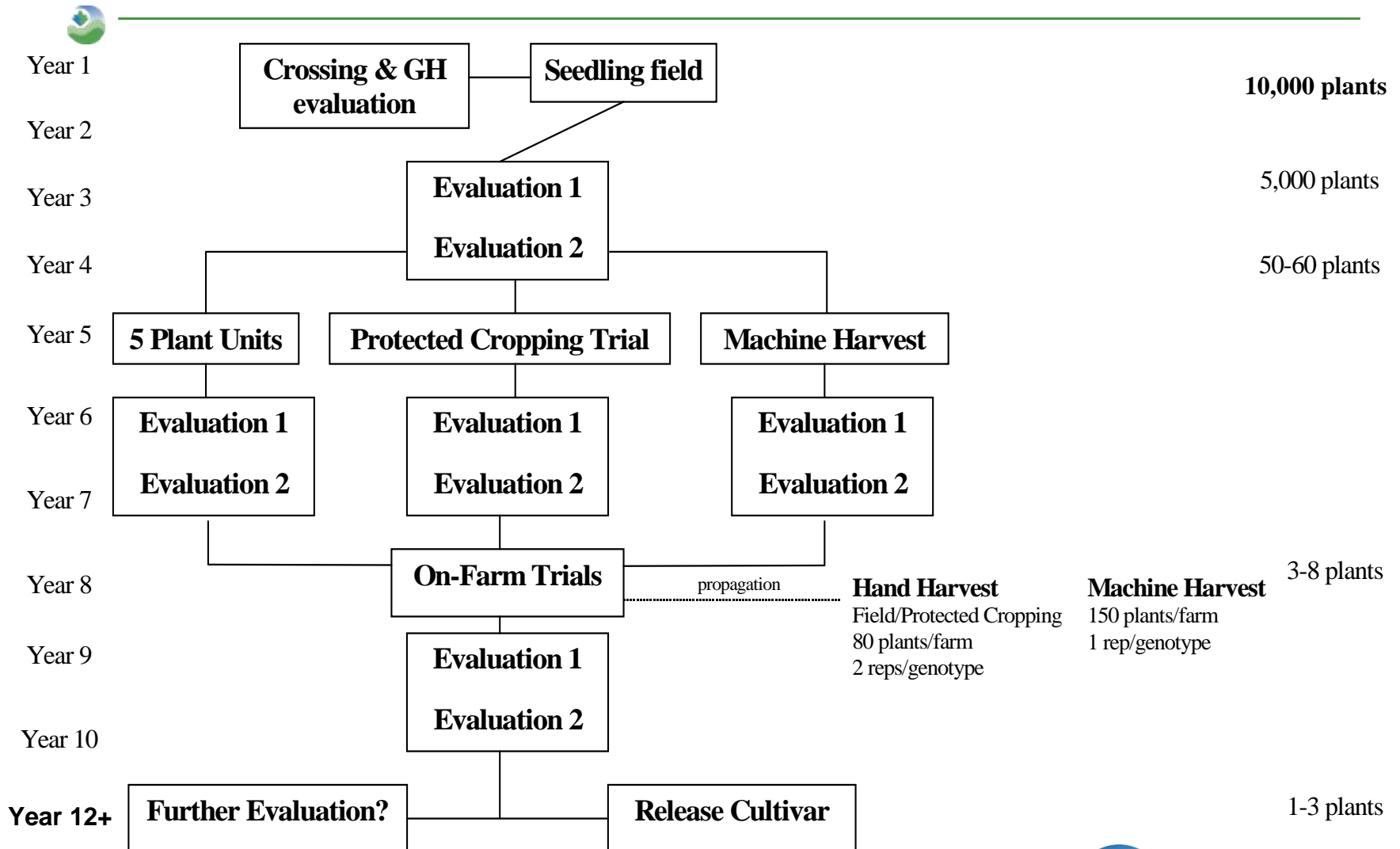
New breeding objectives



- **UK Raspberry Breeding Consortium 2009-2014**
- **Select cultivars suitable for fresh and processing markets**
- **Development of new primocane-fruiting cultivars**
- **New hybrids with improved P&D resistance, especially to *Phytophthora* root rot**
- **Deployment of marker assisted selection strategies**
- **Evaluation of promising material under commercial conditions in grower trials**



Crossing to cultivar release



Conventional breeding for resistance to raspberry root rot (*Phytophthora rubi*)



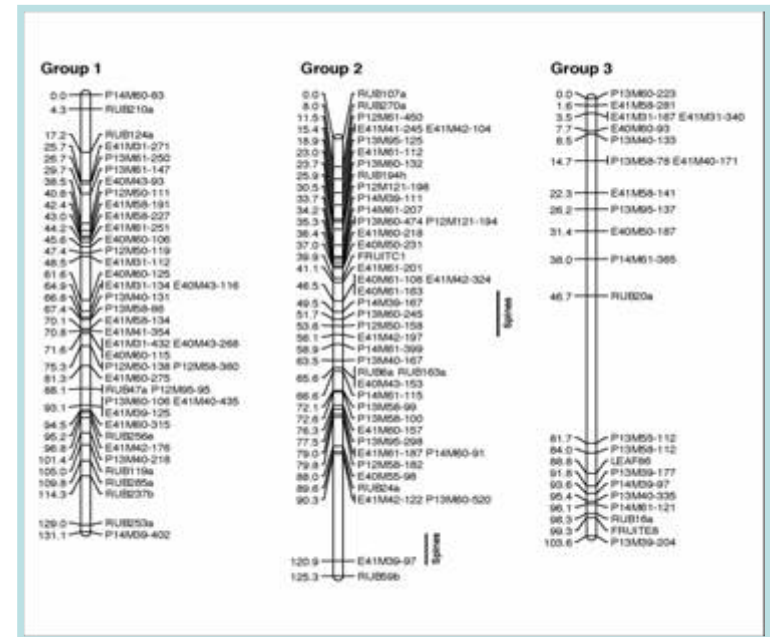
- ~20% of the crossing programme
- Seedlings screened in a deliberately infested field
- Selections are identified when the controls are dead
- 2 selections with putative resistance currently identified
- Additional 4-5 years to breeding timescale



Molecular breeding of raspberry at SCRI



- Hortlink 0169, RERAD Workpackage 1.3
- Mapping population: Glen Moy x Latham
- First raspberry genetic linkage map developed 2004
- Marker development
 - Identify markers associated with important traits
 - Provides a 'toolkit' to identify genotypes with these traits
 - **Creates a more targeted breeding programme with a reduced timescale**



Development of markers for resistance to *Phytophthora* root rot



- Glen Moy (susceptible) x Latham (resistant)
- Strong correlation between root density and resistance
- PCR-based molecular markers developed for screening progenies
- Parents with resistance marker identified for crossing in 2009
- Mapping population further replicated in different cropping systems to map more traits



Linking phenotypes to markers/genes responsible for key trait variation



Key traits mapped

- *Phytophthora* root rot
- *Gene H* and cane diseases
- Sensory characteristics (Hortlink 0170)
 - Colour
 - Fruit size
 - Anthocyanins
- Fruit development / ripening



Traits under investigation

- Fruit softening (Hortlink 0195)
- Crumbly fruit
- Cane splitting
- Leaf hairs / pest resistance



Integrating conventional and molecular breeding



- Conventional crossing will continue
- A good germplasm base is required
- Molecular assisted selection is a valuable ‘toolkit’ which will:
 - Select important traits early in the selection process
 - Eliminate undesirable types before field planting
 - Reduce numbers of early stage breeding material
 - Reduce timescale to cultivar release
- Field trials are necessary after screening
- Results in a more efficient, targetted breeding programme



2010 Season at SCRI



- Marker Assisted Selection deployed
 - *Phytophthora* root rot
 - Fruit size
- Breeding plot evaluation:
 - SCRI Protected cropping system.
 - 20 genotypes in 2 reps (3rd season)
 - 30 genotypes in 2 reps (2nd season)
 - 30 genotypes in 2 reps (1st season)
 - Machine harvest plot
 - 4000 seedlings from 2007 crossing programme
- Aphid screening: resistance-breaking strain
- Primocane-fruiting seedlings
- Micropropagation of new selections for on-farm trials



Industry partners required!



- Technology Strategy Board (TSB) – New approaches to crop protection
- Successor to Hortlink scheme
- Plant physical mechanisms for resistance to P&D in soft fruit/bush crops
 - Root and cane architecture, plant habit
 - Raspberry, blackcurrant, blueberry, strawberry
 - Raspberry model crop
- Industry partners required
 - In-kind contribution (time, field trials)
 - Minimum 10% cash return
- Concept note deadline 25th February

'Fruit For the Future'

SCRI, Thursday 15th July 2010

