PLANT BREEDING FOR THE FUTURE:
Fruit breeding for the twenty-first century

Mrs Wendy Cashmore

Fruit breeding in the 21st C

1. Audacious goals
2. Breeding objectives & approach
3. Faster breeding
4. New technologies
5. IP rights & commercialisation

CIOPORA

CIOPORA – Fruit Section
• New members
• Very honoured to represent

Key initiatives:
• Promoting UPOV membership
• Fostering adoption of up to date legislation
• Championing accessibility of PVR systems & processes
• Arguing for stronger PVR protection

Plant & Food Research

A New Zealand based research and development company
• Providing research & development that adds value to fruit, vegetable, crop, & food products

Key focus
• Plant breeding, especially perennial fruit crops

Audacious goals

To produce more & better food with reduced environmental impacts & fewer inputs

Goals - Novel cultivars

Novel ideotypes that will:
• Change the traditional perceptions of fruit
• Create new market space & demand

The rationale = kiwifruit were green & hairy for 30 years….the range & novelty being developed in that crop could be replicated in others
Goals – sustainable & efficient production

The demand is for cultivars:
• Well-suited to different production regions
• Delivering grower benefits

Goals – consumer benefits

• Increasing recognition of health messages
• Food safety perceptions
• Differing target demographics

Sophistication for breeding success

Genomics & breeding tools
Breed new varieties faster
Consumers

Breeding Objectives

Consumer needs largely dictating breeding objectives

Consumer needs characterised by global food trends:
• Health
• Sustainability
• Convenience
• Novelty
• Sensory appeal

Whole of science approach

Change of emphasis

• Identifying genetic diversity
• Intensive pre-breeding & parental development
• “Cultivar assembly”
  » The creation of readily commercially-adoptable cultivars
Breeding pipeline

Faster Breeding

Minimising time between parental selection & full commercial release

- Identifying potential cultivars early
- Reducing generation time, speeding up delivery
- Increasing commercial releases per unit time
- Increasing efficiencies in the selection cycle
- Reducing the carry over of inferior genotypes

Faster breeding - tools

- High throughput phenotyping
- Extensive & easily accessible databases
- Use of efficient statistical information
  - to choose parents & seedlings
- Selection index approach - multiple characters
- Rapid clonal propagation techniques
- Molecular markers - nursery screening of large populations
- High density plantings
- Clonal rootstocks

New technologies

Knowledge of genetics of key traits to inform breeding process

- Identify & isolate new genes
  - Narrows the search for parents with ideal genetic traits
- Sensory & consumer preference science
  - Determines cultivars that offer characteristics valued by consumers
  - Multidisciplinary research approach

Marker Assisted Selection

Sex marker – in use in kiwifruit & hops breeding:

- Test in the nursery, late winter-early spring
- Discard males
- Plant females in the field in late spring

Tools on the way

For the future, fruit breeders can realistically look to:

- more genetic markers,
- whole-genome selection
- and, more cultivars faster (a greater rate of genetic gain).

The debate will also continue about whether GM offers advantages over other tools and techniques
- Currently no single key trait in fruits that seems to demand a GM answer
The 21st Century unfolding

- Future genetic improvement may take traditional fruit species into new market spaces
- Other fruit genera & species not currently commercially cultivated may yet become economically viable crops

Commercial outcomes

- Identify market opportunities
  » Create objectives to meet those targets
- It’s a long way from invention to market
  » Other capability is required to ensure innovation becomes commercial

Intellectual Property outcomes

- New markers, & breeding tools to get cultivars to market quicker
- Cultivars developed in response to international consumer drivers e.g. with validated health functionality
- Cultivars & propagation systems with better adaptation to climatic change
- New cultivars resistant to key pests & diseases

Intellectual property

- Use of IP tools is well-established in mainstream fruit business
  » Global perspective to commercial development & protection
- IP rights will develop in further territories
  » UPOV will lead introduction & harmonisation among member states
- Scope & use of IP rights will evolve in response to the research & commercial environment

Conclusions

- Consumer & market research will drive breeding objectives
- New technologies will speed up varietal development.
- IP rights will continue to play a strong role in commercial success

We can look forward to many more fruitful years of breeding success in the 21st Century