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

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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
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

- crossing
- selection indices
- physiology
- high health

Germlasm → Seedling populations → Seedling Selections → Small Plot → Large scale → Grower Trials → New Cultivars

Genetic studies → Molecular markers → Sensory studies → Postharvest studies → Path to market

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 21\textsuperscript{st} 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**