Integration of New Breeding Technologies (NBTs) into variety breeding

How to find the right balance for incentivising innovators

Michiel van Lookeren Campagne, Claire Agius, Vicki Locke | March 22, 2023

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Australia’s National Science Agency
Who we are

Australia’s national science agency

One of the world’s largest multidisciplinary science and technology organisations

5,672+ dedicated people working across 53 sites in Australia and globally

State-of-the-art national research infrastructure

We delivered $10.2 billion of benefit to Australia in FY22
CSIRO’s Plant Breeding Activities
Breeding and pre-breeding for the major Australian crops
Top-tier PBR and patent portfolio

Cotton
Originator of all Australian cotton varieties

Cereals, Canola
Trait provider to the breeding industry

Fruits & Nuts
Breeding and trait innovation

Legumes
Innovating to serve the high plant protein demand
# New Breeding Technologies (NBTs): A huge innovation opportunity

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Example</th>
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<tr>
<td><strong>Bringing trait opportunities to vegetatively propagated crops</strong></td>
<td>Disease resistance in grapevine, banana, potato, citrus trees, etc.</td>
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<td>• &quot;Breeding-by-editing&quot; is the only effective method to achieve breeding progress</td>
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<td><strong>Re-wilding</strong></td>
<td>Nematode resistance in cotton</td>
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<td>• Direct conversion of alleles from wild/syntenic sources into elite germplasm without linkage drag associated with large introgression fragments</td>
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<td><strong>Accelerating genetic gain</strong></td>
<td>Only limited by editing system’s cost and germplasm dependency</td>
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<td>• Liberating breeding from the constraint of trait introgression; Parallel trait conversion of all finished (parental) lines at the end of the breeding cycle</td>
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<td><strong>Creating novel allelic diversity</strong></td>
<td>Optimising well-understood plant metabolic pathways, such as photosynthesis, secondary metabolites</td>
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<td>• Most crops have limited allelic diversity at important loci within their elite germplasm pool, leaving a lot of untapped improvement potential</td>
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<td>• Best allele available is not necessarily the optimal allele; Functional genomics and recent breakthroughs in protein structure/function prediction are driving allele optimisation opportunities</td>
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<td><strong>Many other opportunities</strong></td>
<td>Synthetic biology in crops, site-directed recombination, trait switches, etc</td>
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<td>• Technology is immature</td>
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Trait innovation using NBTs and breeding innovation go hand-in-hand

- Breeders and trait innovators both need to be incentivised to use New Breeding Technologies (NBTs)
- Proposed draft text for revision of Explanatory Notes on Essentially Derived Varieties (EDVs) got the balance wrong:
  - Disincentivise the development of new plant varieties using highly innovative NBTs
  - Risk consolidating the control of NBTs with current owners of plant breeders rights and distorting the system in a manner that is at odds with the intention of the breeders’ exemption
  - Lead to commercial uncertainty

- UPOV needs to achieve a balance of incentives agnostic to the method of breeding
Varieties obtained by editing should not be Essentially Derived Varieties (EDVs) by default

- Patents are not always an alternative
  - Patents on plants are not available in many countries and political views on how they should be treated are diverging
  - A key principle of the international PBR regime is to reward incremental breeding. These changes are unlikely to meet novelty and inventiveness requirements
  - Patents are much more expensive than PBR protection

- Increased geographical divergence and complexity
  - Has the potential to stifle innovation and drive industry consolidation
Proposal for fair and clear decision criteria for EDVs

Is the derived variety clearly distinguishable from the initial variety?

YES  →  NO

Is there predominant derivation? (“factually derived from”)

YES  →  NO

Does the change create an innovative variety with differentiating economic value?

YES  →  NO

New variety, no EDV

New variety, no EDV

New variety, EDV

Same variety
What is the opportunity for UPOV to stimulate innovation?

• Reward innovation that creates economic value
  • Fair and clear decision criteria for EDVs needed
  • Safeguarding the breeders exemption
  • Avoiding perverse outcomes

• UPOV principle: Breeding progress is measured by phenotype
  • Veering from that principle would require a complete overhaul
  • Explanatory Notes are not the right way to change the fundamental principles of the UPOV Convention
Thank you

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