ARC Centre of Excellence for
PLANT SUCCESS
IN NATURE & AGRICULTURE

# 2020
# ANNUAL REPORT

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# DIRECTOR'S REPORT

The Australian Research Council (ARC) Centre of Excellence for Plant Success in Nature & Agriculture focuses on the potential of research on natural systems and fundamental genetics and physiology of plants to deliver a step change in improving crop resilience and yield and in understanding how plants adapt to their environment. This will be enabled by new technology in describing systems and networks, manipulating plants at the genetic level and with new legal frameworks.

The Federal Government announced $35m of funding for the ARC Centre of Excellence for Plant Success in Nature and Agriculture on 8 October 2019 together with $7M from five Universities and in-kind from these Universities and thirteen Partner Organisations.

While only formally established for one week in 2020, during the course of the past year, a committed team of Chief Investigators, Associate Investigators, Partner Organisations and professional staff have collaborated on a broad range of pre-establishment activities .
This Report provides an overview of the outcomes of those efforts, which have built the foundation for a successful ARC Centre of Excellence.

*Photo: Chief Investigators and Associate Investigators participated in a series of workshops during 2020*

# STRATEGIC DIRECTION

The ARC Centre of Excellence for Plant Success in Nature and Agriculture draws on its many University and Partner Investigators to deepen and extend knowledge of genetic networks for key functional processes in plants.

Beginning with model plant systems and extending to crops and natural ecosystems, the Centre team is combining biological discovery with advanced mathematics to model and predict nature's mechanisms of adaptation.

The integration of prior knowledge of the revealed mechanisms into genetic prediction and breeding pipelines is a key research theme to translate trait mechanistic discoveries into enhanced rates of genetic gain and crop improvement.

The Centre will accelerate technologies to transfer successful networks into crops and build legal frameworks to secure this knowledge. Our multidisciplinary team will drive the discovery and delivery of new strategies to address the problems of food security and climate change, establishing Australia as a global leader in these areas.

Through its global network of partners, in both industry and academia, and its communication, education, training and mentoring initiatives, the Centre will transform plant science for future generations.

The Centre has developed a clear vision and mission that will enable it to meet its objectives.

## Vision

Empowered, enabled, and guided by an ability to predict and improve plant performance in diverse environments, we will enable the sustainable and productive future of plants in nature and agriculture.

## Mission

We will:

- Develop new, more effective ways of solving persistent problems in nature and agriculture, and inspire others in plant science and beyond.
- Strive to realize the potential of people, research and transdisciplinary approaches through active and broad dialogue and collaboration within the Centre, plant sciences and beyond.
- Become a preferred choice research collaborator and Centre because of our professional and transparent ways of working with intellectual property and contractual commitments, and our high standard of ethics, integrity and inclusion.
- Promote a safe and rewarding workplace where we are all encouraged to be creative thinkers.

## Objectives

Our objectives are to:

- Discover physiological mechanisms and networks of genes underpinning plant success across plant lineages.
- Develop new mathematical theory capable of handling the evolution of gene networks and the linkage of genome to phenome.
- Improve understanding of how different plant systems have evolved.
- Develop theoretical predictions of how different gene networks influence crop productivity / yield and resilience over time and under different environments.
- Validate theoretical predictions by modifying features of genetic networks and testing outcomes in the laboratory and/or field.
- Develop novel legal and social frameworks that encourage acceptance of new technologies and protect the rights of all parties.

# 2020 HIGHLIGHTS

## Centre Charter

During 2020, the Centre established a Charter. Recognising that we have been awarded a unique opportunity, not only to advance research and practice in plant success, but also to make contributions to how we engage in the practice of research itself, the Centre is guided by, and structured according to, three core values - integrity, inclusivity, and international excellence - all of which are required to enable successful transdisciplinary research. The Charter incorporates the Centre Vision and Mission as previously described, an ethics plan based largely on the 2018 Australian Code for the Responsible Conduct of Research and its 8 principles (honesty, rigour, fairness, respect, recognition, accountability and promotion of responsible research practices) and a Behaviours Inventory.

### Behaviours Inventory

The Behaviours Inventory (Box 1) describes elements of trust that underpin the Centre.

The Centre's Chief investigators (CIs) are passionate about providing a safe and productive workplace for researchers that will enable individuals to thrive while providing agency for a highly successful Centre.

The CIs believe strongly that all decisions are evidence based and that evidence is well obtained and communicated. This means the best of active listening and informed feedback for the ongoing improvement of Centre activities including in governance and leadership. We will strive to:

- Change direction or emphasis if it will lead to better outcomes
- Avoid siloed thinking, confirmation bias and unnecessary specialisation or authority
- Be supportive of the person and hard on the issue, such that personal ambition and comfort are maintained, together with a clear demand to meet our mission.
- Develop theoretical predictions of how different gene networks influence crop productivity/yield and resilience over time and under different environments.
- Validate theoretical predictions by modifying features of genetic networks and testing outcomes in the laboratory and/or field.
- Develop novel legal and social frameworks that encourage acceptance of new technologies and protect the rights of all parties.

*Braving* [1]

***Boundaries*** | *You respect my boundaries, and when you're not clear about what's okay and not okay, you ask. You're willing to say no.*

***Reliability*** | *You do what you say you'll do. At work, this means staying aware of your competencies and limitations so you don't over promise and are able to deliver on commitments and balance competing priorities.*

***Accountability*** | *You own your mistakes, apologize, and make amends.*

***Vault*** | *You don't share information or experiences that are not yours to share. I need to know that my confidences are kept, and that you're not sharing with me any information about other people that should be confidential.*

***Integrity*** | *You choose courage over comfort. You choose what is right over what is fun, fast, or easy. And you choose to practice your values rather than simply professing them.*

***Nonjudgment*** | *I can ask for what I need, and you can ask for what you need. We can talk about how we feel without judgment.*

***Generosity*** | *You extend the most generous interpretation possible to the intentions, words, and actions of others.*

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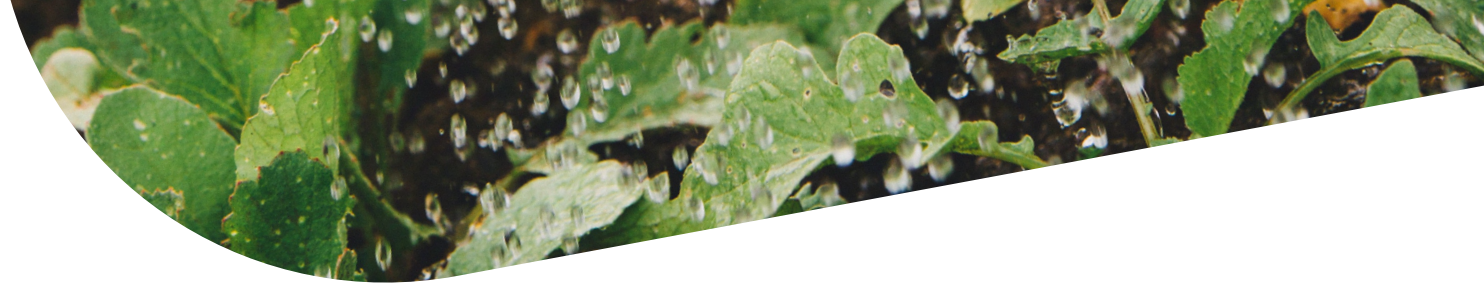

## Research Strategy Planning

Research discussions throughout 2020 provided iterative review of the Centre's broad research programs, whilst developing a range of research projects. This progressive and dynamic dialogue led to a portfolio of projects that typically each span several CIs and several subjects or research areas (Diagram 1).

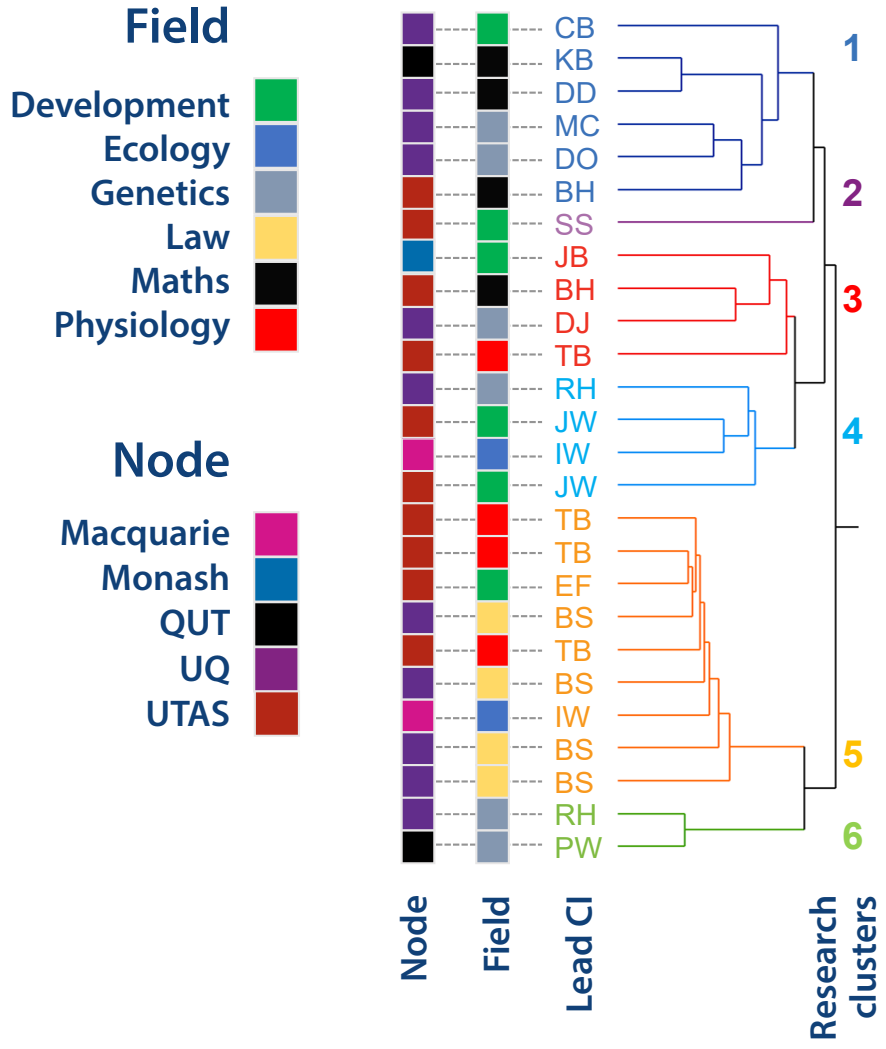


**Diagram 1:** Six research clusters span the 26 projects identified in 2020. The clusters emerged from a 2-way cluster analysis of the Centre's projects and are based on CI contributions to multiple projects. The clusters are shown on the right next to the initials of project lead CIs. Adjacent colours show the lead CI's Node and field of research.

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## Activity Plan 2021

1. Complete recruitment.
2. Develop connectivity with early career researcher group.
3. Establish and review office and laboratory infrastructure.
4. Develop Centre website, intranet, communication plan and outreach plan.
5. Review and develop processes relating to Governance and strategic initiatives.
6. Engage with Centre Advisory Board and Scientific Advisory Panel.
7. Progress activities of the Translation and Impact Committee.
8. Enhance partner engagement.
9. Finalise research project planning and commence high quality research on a path to impact.
10. Implement research reporting processes both internally and externally.
11. Implement strategies to ensure collaboration in a COVID-19 and post COVID era.
12. Conduct official Centre launch.
13. Host first annual conference.

## Capacity Building

The Centre commenced establishment of Early Career Researcher (ECR) Working Groups at the Nodes, with The University of Queensland (UQ) Node establishing the first such group in 2020. Membership of the Groups comprises Post-doctoral researchers, Higher Degree by Research (HDR) candidates, and Honours students. We believe that these cohorts will be enabled to make a greater contribution to science and the community through positive, empowering experiences with the Centre through their participation in a range of initiatives, including:

- development activities such as skills training, leadership development, and writing activities;
- workshopping issues concerning laboratory management and improvements;
- coordination of networking activities to keep ECRs connected with others in the Centre;
- alternatives to travel and other activities impacted by COVID restrictions.

We commenced negotiations with partner institutions to secure scholarship support for the Centre's HDR students, with the aim of ensuring students have adequate levels of support to enable them to pursue research career pathways. The UQ Node has led these discussions, and other Nodes are following suit.

## Centre Website

The Centre launched its interim website **www.plantsuccess.org**. Work is continuing on the development of the Centre's full website.

## Governance & Operations

Under the leadership of the Centre Director, regular meetings of Node Leaders were established. This enabled comprehensive planning of strategic and operational issues and resulted in terms of reference being produced for the Centre's governance and management committees, including the Centre Advisory Committee, the Science Advisory Panel, the Centre Executive Committee, the Centre Translation & Impact Committee, the Outreach Working Group and the Researcher Development Working Group.

We have commenced recruitment of external members to relevant committees. Additionally, as the Centre is committed to fostering leadership skills and open communication, opportunities have been created for our ECRs, including Postdoctoral researchers and HDR students, to have representation on the Centre's committees and working groups.

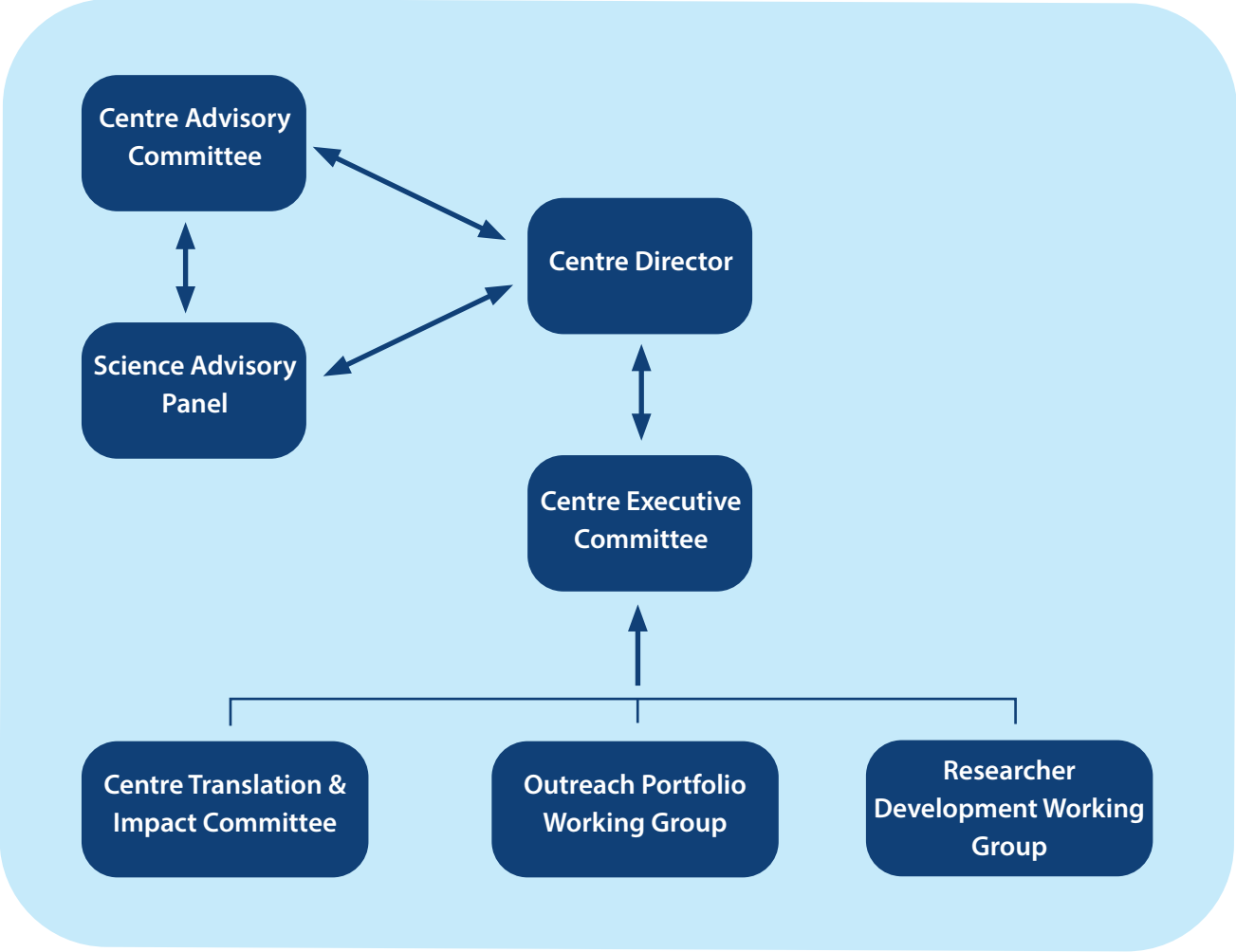


**Diagram 2:** The Centre's committee structure

The organisational structure for the Centre's professional staff was established, with the creation of the Centre Office for Research Management and Support (CORMS[2]).

The statement of purpose of the CORMS team is MERISTEM, or **M**obilising and **E**nabling **R**esearch **I**nnovation, **S**cience **T**ranslation, **E**ducation and **M**entoring.[3]

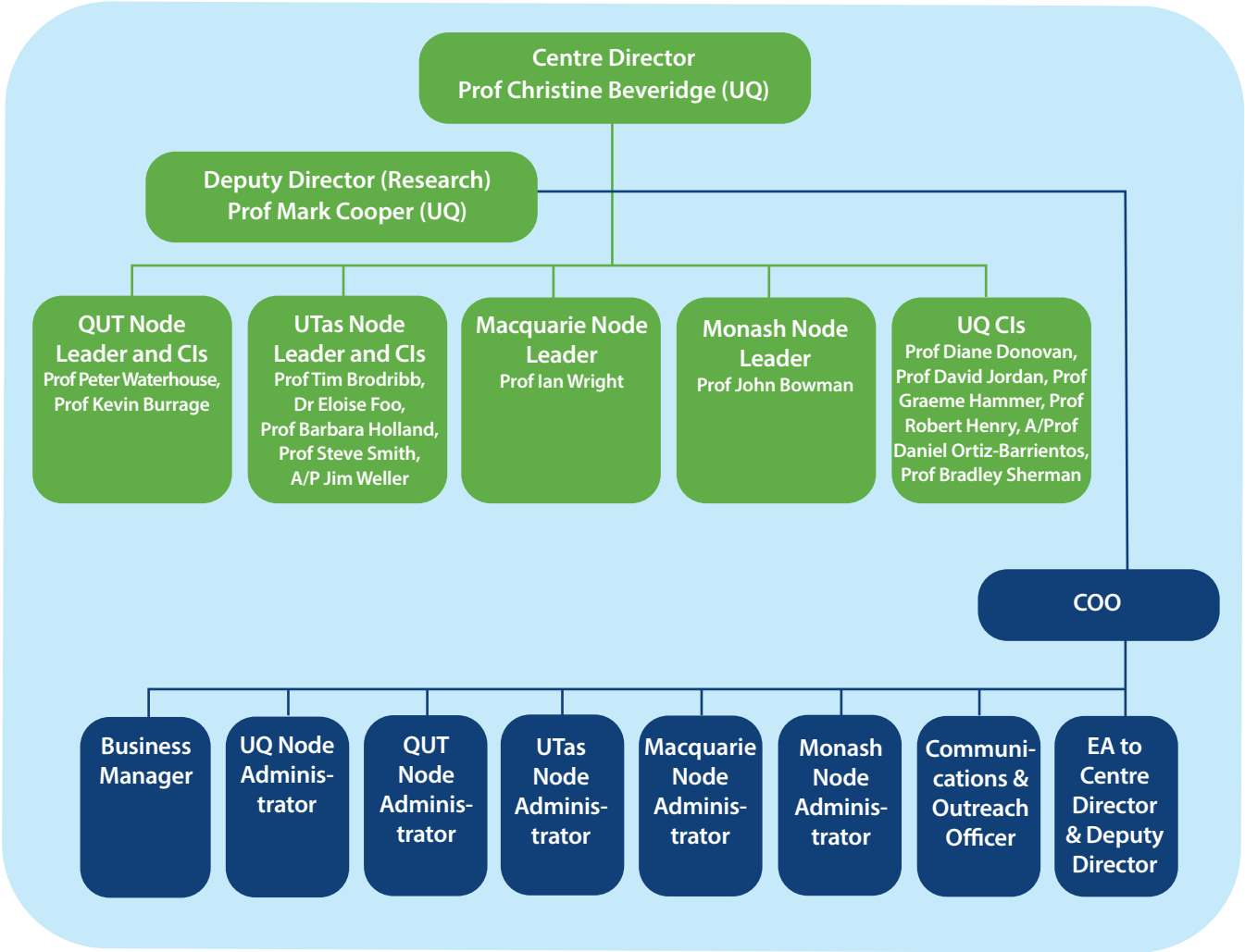


**Diagram 3**: The Centre's organisational structure

## Outreach

A key aspect of the Centre is to ensure that our research outcomes are understood and valued by society.
To achieve this, we will partner with leaders in the fields of education, communication and social engagement to create a strong, relevant footprint in the community.
This will be driven by our Outreach Portfolio, with support from our Chief Operating Office and our Communications and Outreach Officer, with the aim of facilitating and growing connections within and beyond the Centre.

The Stephanie Alexander Kitchen Garden Foundation (SAKGF) is the Centre's educational partner. During 2020, SAKGF and the Centre mapped out project ideas and education and training programs for the short, medium and long term.

2 The professional services team has taken its name from the plant term "corm". Corm is present in certain plant types and helps them to survive adverse conditions.

3 Meristem is a type of tissue found in plants and is responsible for the primary and secondary growth of plants.

# RECRUITMENT

Opportunities for Post-doctoral researchers and Higher Degree by Research students to work on projects within the Centre were identified as a result of the analysis of research projects undertaken at the workshops held during 2020. This resulted in a number of recruitment opportunities being planned in 2020.

However, as a result of COVID, international and national travel restrictions constrained the Centre's plans for recruitment. While a domestic Post-doctoral candidate was appointed, we are now looking to recruit additional suitable candidates for commencement in early 2021.

The Centre's Business Manager was appointed in October 2020. Recruitment processes for the appointment of other key professional staff, including the Chief Operating Officer, the Node Administrators, the Communications & Outreach Officer, and the Project Administrator/Executive Assistant were also put in place.

We aim to finalise key research and professional appointments in early 2021.

# KEY PERFORMANCE INDICATORS

The Centre submitted its schedule of Key Performance Indicators (KPIs) to the ARC in November 2020 and received approval of them in February 2021.

While during the Centre establishment phase, staff and CIs produced wide and varied outputs and engaged in many activities relevant to KPIs, many of which are described above, none were produced during the period from the formal commencement of the Centre on 22 December to 31 December 2020, and therefore none are reported here with respect to Centre Outputs or KPIs.

# ORGANISATIONAL SUPPORT

With the exception of a decrease in the amount of support from Bioplatforms Australia who have decreased the amount originally committed to the Centre from $500,000 to $300,000, participating institutions and partner organisations have not deviated from the cash and in-kind contributions originally agreed to.

# CONTACT DETAILS


**Centre Director: Professor Christine Beveridge**

**T:** +61 7 336 57525
**M:** +61 410 648 830
**E:** c.beveridge@uq.edu.au

**E:** plantsuccess@uq.edu.au
**W:** www.plantsuccess.org


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## Our Partners

Australian Government Australian Research Council
MACQUARIE University SYDNEY·AUSTRALIA
MONASH University
THE UNIVERSITY OF QUEENSLAND AUSTRALIA
QUT
UNIVERSITY of TASMANIA
BIOPLATFORMS AUSTRALIA
CROP TRUST
CORTEVA agriscience
CSIRO
Stephanie Alexander KITCHEN GARDEN FOUNDATION Growing Harvesting Preparing Sharing
CIMMYT International Maize and Wheat Improvement Center
THE UNIVERSITY OF BRITISH COLUMBIA
MAX PLANCK INSTITUTE OF MOLECULAR PLANT PHYSIOLOGY
Colorado State University
UNIVERSITY OF SASKATCHEWAN
Queensland Government
HARVARD Faculty of Arts and Sciences