Australian Government
Australian Research Council

EI 2018 ENGAGEMENT AND IMPACT

Engagement and Impact 2018

The University of Western Australia

UWA07 (HLS) - Impact

Overview

Title

(Title of the impact study)

High returns on Canola investment

Unit of Assessment

07 - Agricultural and Veterinary Sciences

Additional FoR codes

(Identify up to two additional two-digit FoRs that relate to the overall content of the impact study.)

06 - Biological Sciences

Socio-Economic Objective (SEO) Codes

(Choose from the list of two-digit SEO codes that are relevant to the impact study.)

82 - Plant Production and Plant Primary Products

97 - Expanding Knowledge

Australian and New Zealand Standard Industrial Classification (ANZSIC) Codes

(Choose from the list of two-digit ANZSIC codes that are relevant to the impact study.)

01 - Agriculture

Keywords

(List up to 10 keywords related to the impact described in Part A.)

agricultural breeding

molecular genetics

hybrid technology

crop production

canola

yield

disease resistance

Council of Grain Grower Organisations Ltd

Grains Research Development Corporation

NPZ

Sensitivities

Commercially sensitive

No

Culturally sensitive

No

Sensitivities description

(Please describe any sensitivities in relation to the impact study that need to be considered, including any particular instructions for ARC staff or assessors, or for the impact study to be made publicly available after EI 2018.)

Aboriginal and Torres Strait Islander research flag

(Is this impact study associated with Aboriginal and Torres Strait Islander content?
NOTE - institutions may identify impact studies where the impact, associated research and/or approach to impact relates to Aboriginal and Torres Strait Islander peoples, nations, communities, language, place, culture and

knowledges and/or is undertaken with Aboriginal and Torres Strait Islander peoples, nations, and/or communities.)

No

Science and Research Priorities

(Does this impact study fall within one or more of the Science and Research Priorities?)

Yes

Science and Research Priority	Practical Research Challenge
Food	Enhanced food production

Impact

Summary of the impact

(Briefly describe the specific impact in simple, clear English. This will enable the general community to understand the impact of the research.)

UWA's sustained research program into molecular genetics and the identification of molecular markers in canola crossbreeding has led to the development and release of 50 new improved canola varieties since 2004, with higher yield, disease resistance, and herbicide tolerance for weed control, thereby improving the long-term sustainability of Australian cropping systems. These canola varieties which have been adopted by farmers because of their higher yield and disease resistance, allow more sustainable crop rotations and improved farm profits. Significant economic benefits have also been delivered to seed production and distribution companies. New breeding methods have the potential to improve crop adaptation to climate change.

Beneficiaries

(List up to 10 beneficiaries related to the impact study)

Landmark / Seednet

Bayer Australia Ltd

DL Seeds (Canada)

Grains Research and Development Corporation (GRDC)

Monsanto Australia Ltd

Council of Grain Grower Organisations Ltd

Canola growers in Australia, South Africa, Germany and Canada

Dupont Pioneer (GenTech Seeds Pty Ltd)

Norddeutsche Pflanzenzucht Hans-Georg Lembke KG (NPZ)

Seed Force Pty Ltd

Countries in which the impact occurred

(Search the list of countries and add as many as relate to the location of the impact)

Australia
Germany
Canada
South Africa

Details of the impact

(Provide a narrative that clearly outlines the research impact. The narrative should explain the relationship between the associated research and the impact. It should also identify the contribution the research has made beyond academia, including:
- who or what has benefitted from the results of the research (this should identify relevant research end-users, or beneficiaries from industry, the community, government, wider public etc.)
- the nature or type of impact and how the research made a social, economic, cultural, and/or environmental impact
- the extent of the impact (with specific references to appropriate evidence, such as cost-benefit-analysis, quantity of those affected, reported benefits etc.)
- the dates and time period in which the impact occurred.

NOTE - the narrative must describe only impact that has occurred within the reference period, and must not make aspirational claims.)

Research at The University of Western Australia (UWA) has significantly impacted Canola production. Canola is a broadleaf rotation crop grown for the oil extracted from its seed, which produces margarine, oils and stockfeed. It is a significant crop grown throughout south-eastern, southern and western agricultural areas of Australia. Western Australia, in particular, is dominant in canola production, accounting for around 40% of the nation's five year average production of 3.5 million tonnes, with national canola exports currently at a five-year average value of around $1.25 billion per annum.

The long-term support of canola breeding projects at UWA, in partnership with private companies, has resulted in significant economic impact for the Australian canola industry. Beginning in 2000, a sustained research program into molecular genetics and the identification of molecular markers in canola crossbreeding has led to the development and release of 50 new improved canola varieties since 2004, with higher yield, disease resistance, and herbicide tolerance for weed control, thereby improving the long-term sustainability of Australian cropping systems. The beneficiaries have been canola seed producers and distributers, as well as growers and agricultural industries. Growers have seen an increase in whole-farm profit by using improved canola varieties, while there have been other flow-on benefits to the agricultural industry through increased sales of machinery, fertiliser and chemicals, and through the transport, storage and processing of more harvested seed.

Demonstrated increases in profitability of canola are now at the point where canola is considered to be the most profitable crop in many areas of Southern and Western Australia. UWA-derived canola varieties have contributed significantly to canola production in Australia, especially in medium to low rainfall areas across Southern Australia. The 2016 National Variety Trials showed an overall 15% yield increase in UWA varieties compared with other canola varieties, resulting in an improved production value of an estimated $240 per hectare.
Canola production in Western Australia nearly doubled during the 2000's and the Canola Breeders project at UWA was a major reason for this expansion. One variety released by the Canola Breeders program at UWA, named CB Tanami, was grown in low rainfall regions and represented 13% of canola deliveries in Western Australia in 2009, adding $67 million of income to Western Australian growers and agricultural industries.

The benefits of improved canola varieties accelerated when the Canola Breeders program at UWA released the first hybrid triazine tolerant canola varieties in 2009. The individual results of these varieties had yield improvements of between 118% and 134% in comparison with the control variety, ATR Cobbler.

Since that time, UWA-bred top yielding canola hybrids have been trialled in international markets, including Argentina, Chile and South Africa. For example, the conventional hybrid variety CB Agamax and triazine tolerant hybrid variety CB Jardee HT are sold by Norddeutsche Pflanzenzucht Hans-Georg Lembke KG (NPZ) on a regular basis into South Africa.

More recently, hybrid canola varieties developed at UWA have been licensed by NPZ to Australian commercial partners including Dupont Pioneer (GenTech Seeds), Bayer Australia, Seed Force, and Landmark/Seednet. Seed Force have reported that the “broader product range is giving us more business buffer against negative livestock or specific crop commodity pricing and is helping us to expand our customer base”. They also estimate a fourfold increase in profits as a result of access to the hybrids developed via the UWA canola breeding program as reported by the Director of Australian Business Development.

Bayer CropScience have experienced similar benefits with the Business Development Manager (Seeds &Traits) reporting, “the canola breeding program led by Wallace Cowling at UWA have demonstrated the ability to Bayer to breed high performing varieties through long term attention and effort. Our latest varieties licensed from the program are highly competitive in the marketplace and rewarding to both farmers and Bayer alike.” He also reported that one of the new NPZ/UWA varieties, InVigor® T4510, is now Australia’s leading TT hybrid on both performance and value with the latest Australia-wide NVT trials results showing that it is "an amazing 15% ahead of the standard benchmark varieties in the market".

In 2016, three UWA-derived varieties, including InVigor® T4510, out-yielded competitor varieties. This was due to their higher yielding ability across a wide range of cropping zones, and stronger disease resistance. In 2017, 100,000 hectares of UWA-bred canola hybrids were sown, and this is predicted to rise to 500,000 hectares in 2018. Consequently, the licensees are excited at the prospect of achieving high sales of these hybrid varieties in the Australian and global markets in 2017 and beyond.

Associated research

(Briefly describe the research that led to the impact presented for the UoA. The research must meet the definition of research in Section 1.9 of the EI 2018 Submission Guidelines. The description should include details of:
- what was researched
- when the research occurred
- who conducted the research and what is the association with the institution)

Research using genetic modification and blackleg disease resistance was undertaken at UWA in the early 2000s, under contract to Canola Breeders. UWA researchers introduced a doubled haploid methodology to accelerate canola breeding. Blackleg disease resistance genes were introduced to Australia from Canada through the company project based at UWA, where molecular markers were used to rapidly transfer the genes to Australian-adapted canola varieties. New varieties bred using this technology were released from 2004.

Research on a new breeding methodology was undertaken in a unique interdisciplinary research project from 2005-2015, which adapted animal breeding methods to crop breeding.

In 2016, a collaborative research project with animal breeding experts at the University of New England showed that the new method could potentially double genetic gain in crop breeding for economic traits. UWA staff employed on CB/NPZ projects work in physical proximity to other UWA researchers involved in genetics and breeding (in the UWA Institute of Agriculture, School of Biological Sciences, and School of Agriculture and Environment).

The key researchers are Professor Wallace Cowling, Professor Kadambot Siddique, Research Associate Professor Matthew Nelson, Associate Professor Guijun Yan, Research Assistant Professor Sheng Chen, Professor Zed Rengel, and Professor Martin Barbetti, Professor David Edwards, Professor Jacqueline Batley and Professor Timothy Colmer.

FoR of associated research

(Up to three two-digit FoRs that best describe the associated research)

07 - Agricultural and Veterinary Sciences
06 - Biological Sciences
05 - Environmental Sciences

References (up to 10 references, 350 characters per reference)

(This section should include a list of up to 10 of the most relevant research outputs associated with the impact)

Cowling, W.A. 2013. Sustainable plant breeding. Plant Breeding 132:1-9.

Guo, Y.M., Chen, S., Nelson, M.N., Cowling, W.A. and N.C. Turner. 2013. Delayed water loss and temperature rise in floral buds compared with leaves of Brassica rapa subjected to a transient water stress during reproductive development. Functional Plant Biology 40:690–699.

Annisa, Chen, S. and W.A. Cowling. 2013. Global genetic diversity in oilseed Brassica rapa. Crop and Pasture Science 64:993–1007.

Geng, X.X., Chen, S., Astarini, I.A., Yan, G.J., Tian, E., Meng, J., Li, Z.Y., Ge, X.H., Nelson, M.N., Mason, A.S., Pradhan, A., Zhou, W.J. and W.A. Cowling. 2013. Doubled haploids of novel trigenomic Brassica derived from various interspecific crosses. Plant Cell, Tissue and Organ Culture 113:501–511.

Annisa, Chen, S., Turner, N.C. and W.A. Cowling. 2013. Genetic variation for heat tolerance during the reproductive phase in Brassica rapa. Journal of Agronomy and Crop Science 199:424–435.

Guo, Y.M., Turner, N.C., Chen, S., Nelson, M.N., Siddique, K.H.M. and W.A. Cowling. 2015. Genotypic variation for tolerance to transient drought during the reproductive phase of Brassica rapa. Journal of Agronomy and Crop Science 201:267–279.

Cowling, W.A., Stefanova, K.T., Beeck, C.P., Nelson, M.N., Hargreaves, B.L.W., Sass, O., Gilmour, A.R. and K.H.M. Siddique. 2015. Using the animal model to accelerate response to selection in a self-pollinating crop. G3 Genes Genomes Genetics 5:1419-1428.

Cowling, W.A. 2015. The challenge of breeding for increased grain production in an era of global climate change and genomics. World Agriculture 5(1):50-55.

Cowling, W.A., Li, L., Siddique, K.H.M., Henryon, M., Berg, P., Banks, R.G. and B.P. Kinghorn. 2017. Evolving gene banks: improving diverse populations of crop and exotic germplasm with optimal contribution selection. Journal of Experimental Botany doi:10.1093/jxb/erw406 (on-line 10 November 2016)

Salisbury, P.A., Cowling, W.A. and T.D. Potter. 2016. Continuing innovation in Australian canola breeding. Crop and Pasture Science 67:266-272

Additional impact indicator information

Additional impact indicator information

(Provide information about any indicators not captured above that are relevant to the impact study, for example return on investment, jobs created, improvements in quality of life years (QALYs). Additional indicators should be quantitative in nature and include:
- name of indicator (100 characters)
- data for indicator (200 characters)
- brief description of indicator and how it is calculated (300 characters).)

Name

Testimonial

Indicator Data

testimonials from beneficiaries confirming economic and industry benefits

Indicator Description

The licensees report increased economic value of UWA-bred hybrids, and highlight the broader impact on their business sustainability. Testimonials have been obtained by the University from SeedForce.