QAAFI 2014

Annual Report to the Queensland Government

Queensland Government

The University of Queensland
AUSTRALIA

QAAFI
Queensland Alliance for Agriculture and Food Innovation

COVER: Northern beef herd image by QAAFI research scientist and veterinarian Dr Geoffry Fordyce.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The institute has met or exceeded each of its key performance indicators to the Queensland Government, fulfilling its commitment under the Alliance Agreement.

As well as attracting more than double the institute's projected grant income, QAAFI scientists have achieved another strong result in developing new technologies and communicating their research to industry. There were more than 130 positive media stories throughout 2014, which featured QAAFI research scientists or quoted the work or aims of the institute, suggesting an increased awareness of the QAAFI brand across industry and among Queensland's primary producers.

QAAFI's research grants and consultancy sources continue to diversify, demonstrating the value industry places upon its scientific expertise. New key projects were funded within the Centre for Plant Science, including a new $22 million ARC Centre of Excellence for Translational Photosynthesis and an increase in GRDC funding for legumes and agronomic decision making.

The Centre for Nutrition and Food Science has continued to develop links between the farm gate and the consumer in collaboration with DAF. High zeaxanthin 'SuperGold' corn is close to commercial licence, and the prawn industry is adopting Kakadu plum extract to enhance prawn shelf life. The Queensland drought and restructure of MLA has undoubtedly had an impact on the Centre for Animal Science but the centre has continued to maintain its research income despite these challenges.

QAAFI's interactions with both national and international organisations are a reflection of increased awareness of QAAFI's ability to deliver world-class research expertise in agriculture, food and nutrition science. The large number of influential national and international visitors throughout the year is an indication of the institute's strong position within Australia and internationally.

In October 2014, for example, QAAFI's influence was pivotal to The University of Queensland being ranked among the world's top 10 universities in agricultural science – according to the National Taiwan University (NTU) rankings. These rankings are one of four major independent measures widely used to evaluate university performance based on scientific papers, research productivity, impact and excellence.

The quality of QAAFI's scientific research flows through to the university's ability to deliver a world's top 10 education in agricultural science for graduate and post-graduate students. As an independent enrolling unit, QAAFI's 100 Research Higher Degree students are another sign of the institute's steady growth and increasing recognition.

Moreover, many of these positive sentiments were reflected in the annual survey of external funding agencies. A full strategic overview of QAAFI's activities and achievements supported by the government's grant during the year is detailed in this report.

SUMMARY OF KEY PERFORMANCE INDICATORS

Performance Measure	Target 2014	Achieved 2014
Number of refereed publications	90	177
Total grant income	$12 M	$22.6 M
Number of research consultancies	5	62
Number of research higher degree (RHD) students	50	100
Number of RHD completions	15	17
Number of national/ state/local policy reports and industry/government briefings	25	116
Visitors to QAAFI of national and international profile	30	146
Number of memberships of national and international professional committees	13	129
Media profile (positive media events)	15	133
Advice provided to a QG Minister or Department	10	15
Number of types (types to be presented descriptively) of new or improved technologies published	20	138
Annual survey results of external funding agencies	Highly satisfied with QAAFI	Highly satisfied with QAAFI. See appendix A
Level of satisfaction by industry (based on feedback from industry representatives on Advisory Board).		Advisory board's role and composition under review

QAAFI CONSOLIDATED INCOME & EXPENDITURE 2014

REVENUE	
External Revenue	
Research Block Grants	3,390,695
Tuition Fees	726,760
Research Income	22,631,342
Investments, Scholarships & Donations	382,178
Commercial Services Fees	703,903
Other Income	108,497
Total External Revenue	**27,943,375**
Internal Allocations	**(329,174)**
TOTAL REVENUE	**27,614,201**
EXPENDITURE	
Salaries & Employment Costs	14,106,700
General Operating Expenses	2,130,494
Services	10,002,133
Equipment & Minor Works	892,898
Travel	976,384
Hospitality	100,010
Scholarships	614,567
Collaborative Research Payments	2,535,184
Other Expenses	48,809
TOTAL EXPENDITURE	**31,407,178**
Operating Result	**(3,792,977)**
Carry Forward	7,885,711
Accumulated Position	**4,092,733**

DEFINITIONS:

Research Block Grant – internal allocation of income from UQ derived from federal government grants based on research performance.

Tuition fees – fees an international student pays for each program or course.

Research income – includes income from external sources, including DAF.

Investments, Scholarship and Donations – includes scholarships, grants, donations, and prizes.

Commercial Services and Fees – revenue for delivery of services internally and for external parties, including consultancies.

Other income – various income including refunds and reimbursements for activities conducted by staff on behalf of other organisations.

Services – various payments for services including IT, analytical, testing, and including the research service payments associated with UQ/DAF sub agreements.

Collaborative Research Payments – payments made to research collaborators subcontracted to participate in UQ led research, funded externally.

1. Number of research consultancies conducted

ANIMAL SCIENCE		
	National consultancies Ongoing Invitation by MLA to supply expert advice to: (i) Assist in final development of 'Intensive industry phenotyping and genotyping for genetic improvement of reproduction in northern Australia' Project, MLA Headquarters, Brisbane, 7 Feb 2014. International consultancies Assisted with the design of Brahman and Droughtmaster breeding programs in PNG.	Dr Brian Burns
	Court-appointed expert – conducted site inspection, reviewed scientific literature, viewed video footage, responded to lay witness statements and prepared and delivered a statement of evidence to the Planning and Environment Court, Brisbane.	Dr Carol Petherick
	Consultancies – at four piggeries and three poultry farms to solve their respiratory pathogen problem and recommend the selection of strains in the vaccine. Specialised reference laboratory service for the pig and poultry industry to assist with decision making for treatment and vaccination programs.	Dr Conny Turni
	Meat and Livestock Australia – priority list of endemic diseases for the red meat industries: identify the endemic diseases of highest importance to the grazing beef, sheep and goat industries of Australia, and quantify their impact and the potential to reduce their impact. Department of Agriculture & Food, WA – Northern Beef Futures: as part of a reference group, establish the project structure in which recommendations from R&D will be implemented in northern WA's cattle industry, both in production and the supply chain.	Dr Geoffry Fordyce
	Northern Territory Department of Primary Industries – Genetic Identification For Pentastome Taxonomy: Identify genetic markers suitable for species level classification of pentastomes. Bioproperties Pty Ltd – Quantification of *coccidia* load in samples from commercial company: real time PCR analysis of industry samples to quantify parasitic *eimeria* oocyst numbers.	Dr Jess Morgan
	Breeding for improved carcass quality developed 'within herd' genetic evaluation completed for the large beef group, Australian Agricultural Company – this evaluation system provides routine breeding values for their cattle population on 17 economically important traits including, growth, feed efficiency and carcass quality traits.	Dr Mathew Kelly

	MLA – understanding of the relationship between *Bos indicus* content and consumer eating quality – final report submitted for MLA project, 'Utilising genetic markers to improve the under-standing of the relationship between *Bos indicus* content and consumer eating quality'. It was found that the current system of using an estimate based on hump height was adequate for use in standard MSA production, however where more accurate estimates are required, such as in MSA pathways experiments, genetic marker based estimates of breed composition should be used.	
	Animal Health Australia – review of the risk of entry of screwworm into Australia and recommendations on surveillance requirements. Large animal pharmaceutical Intervet Australia Ltd (Dr Petr Fisara) – effectiveness of insecticidal compounds against buffalo fly (*Haematobia exigua*) in contact and feeding assays. Australian Wool Innovation – breeding for breech-strike resistance. Produce a report for AWI identifying successes and shortcomings of research and extension program and make recommendations on opportunities for improvements in future activities.	Dr Peter James
	Participation in the North Australia Beef Research Council meeting, Rockhampton, may 2014.	Dr Rob Dixon
	Zoetis Australia – serological prevalence of pathogens in feedlot cattle. Completed testing of cattle samples and written report to Zoetis (Australia) on the exposure of feedlot cattle to *Mycoplasma bovis*, including animal population details.	Dr Tim Mahony
HORTICULTURE	Consultant – Sugar Research Australia, regarding cause of Yellow Canopy Syndrome. Consultant – Palm oil company CENIPALMA, Colombia to provide advice on research needs and solutions to their bud rot in oil palm dieback problem.	Prof. André Drenth
	Access Stone fruit cultivar evaluation project – Horticulture Australia Limited. Assess stone fruit cultivar evaluation for scientific rigour, industry relevance and evaluate augments regarding public investment in this research. Review submitted 12 June 2014.	Dr Bruce Topp
	Seed genetic analysis and comparison for positive biofuel traits – Uniquest/seed energy. Predict seed-lot values for traits influencing biofuel production in *Eucalyptus dunnii*. Analysis of breeding trial data – Sugar Research Australia. Extend software for streamlined routine analysis of phenotypic data form phase 1, 2 and 3 genetic trials in the SRA breeding program. RosBREED (Combining Disease Resistance With Horticultural Quality In New Rosaceous Cultivars). Developing and deploying new apple DNA tests – Washington Tree Fruit Research Commission.	Dr Craig Hardner
	Post-harvest disease control in avocados – produced report for the large chemical company Syngenta Australia Pty Ltd on efficacy of fungicides to reduce postharvest diseases in avocado. Made recommendations for further assessment.	Dr Elizabeth Dann

	Invitation-only meeting to attend Accelerate Pathway Workshop (GATES Foundation, Seattle, April 2014) with Duncan Ferguson from UniQuest to move innovative technologies towards market. Agricultural Research Connections workshop, Kenya (June 2014) to participate in development of linkages with Africa in the area of Agriculture.	Dr Neena Mitter
	Invitation-only meeting of international participants at the 2014 African Research Connection Workshop, Nairobi, Kenya by Bill & Melinda Gates Foundation, Seattle USA, 15-21 June 2014.	Dr Olufemi Akinsanmi
BROAD-ACRE CROP SCIENCE	Climate change and impacts on rice production in Vietnam: Pilot testing of potential adaptation and mitigation measures. Consultant with Bioforsk Norway to work with the Vietnam Academy of Agricultural Sciences (VAAS) to plan, implement and review an experimental program to mitigate impact of climate change on rice production in Vietnam.	Dr Andrew Borrell
	Large seed company Pacific Seeds Pty Ltd – Land use area cropped and fallow for 2013 to 2014: Producing report and maps to provide indication of the area of fallow available for the 2014 summer cropping season for north-eastern Australia.	Dr Andries Potgieter
	Australian Centre for International Agriculture Research (ACIAR) and Grains Research Development Corporation (GRDC). The report identified information gap in the tactical agronomic management of wheat, sorghum and maize crops in the northern region. Department of Foreign Affairs and Trade (DFAT) Course Advisor 2014. Allocate applicants to DFAT Australia's Fellowship to Australian Universities and supervisors.	Dr Daniel Rodriguez
	Contributor to consultancy – 'Strategic Study of Biotechnology Research in CGIAR' Report Nov 2014, Independent Science and Partnership Council, CGIAR. Contributor to consultancy – 'Indicators of grain productivity on central Queensland farms, and a research protocol to measure the impact on productivity of subsidence after long-wall coal mining' Report Sep 2014 (commissioned by the Springsure Creek Coal Project Agricultural Co-existence Research Committee).	Prof. Graeme Hammer
	Heat and Drought Wheat Improvement Consortium – invitation-only meeting of experts in the field run by Wheat CRP, Bayer Crop Science, CIMMYT, ICARDA, and the Wheat Initiative, Frankfurt, Germany. 2-4 Dec 2014. Water Productivity Traits Strategy – expert consultancies run by GRDC to guide future investments in this area, Sep 2014. Wheat Initiative Expert Working Group on Crop and Plant Modelling – meeting of experts in the field run by the Wheat Initiative, Clermont Ferrand, France 14 June 2014.	Dr Karine Chenu
	Sugar Research Australia (for Dept of Environment) – Nitrogen use efficiency of the Australian sugar industry. Lead a review of nitrogen management in the Australian sugar industry, identifying knowledge gaps and included recommending future research	Dr Mike Bell

	direction. Deliverables include a report on NUE data synthesis and analysis, identification of research gaps and recommendations for future research projects and field trials.	
	International forestry company operating in Queensland – use of a fly ash-based fertiliser to enhance tree growth. Major report produced based on five years' research activities and observations from Bundaberg field sites. Report presented March 2014. Observations at field sites will continue for several years as the trees mature. Biotel Thermophilic Composting Process – analysis of the composition of the composts produced from various waste sources and subsequent recommendations regarding their usefulness as fertilisers. Soil technology company – provide expert advice and assistance on the extraction of humic substances from peat for use in liquid fertilisers and other plant growth stimulants.	Prof. Roger Swift
	A study report to ACIAR on the adoption of outputs of the project Productivity and marketing enhancement for peanut in PNG and Australia (SMCN 2004/041).	Dr Rao (RCN) Rachaputi
FOOD SCIENCE	AGAUR (Catalan agency for the administration of university grants and awards) – grant proposal evaluator. Large food multinational – global leader pet food producer based in the USA. Consultancy based on feline taste receptor research. Large Japanese food additive company – consultancy relevant to the use of MSG as a potential substitute for table salt. Feed and feed specialties for two large pork producers based in Queensland. Partnership in Pork CRC funded project (commercial scheme) developing novel feed additive. Advice to feed and feed specialties producer. Partnership as part of an Australian Pork Limited project related to manipulation of feed intake in pigs. Research partnership with flavour and fragrance producer based in Spain – meat volatiles (including a UQ PhD student). Research partnership with the two large Australian poultry producers on the scope of the chicken meat RIRDC funded grant. Title: 'Dietary manipulation of nutrient specific appetite in broiler chickens'.	Dr Eugeni Roura
	Native Australian extracts – exploring new applications for value addition of food. Conduct research and provide evidence to industry of the novel food applications for native Australian plant extracts. Supporting Australian papaya and papaw growers to increase market share. Implement research of Australian papaya varieties to determine consumer liking for specific sensory characteristics of the fruits, identify preferred varietals and provide a report for industry application.	Dr Heather Smyth

	Dietary Fibre from sugarcane – properties and opportunities. Visit production plant to discuss future research opportunities.	Prof. Mike Gidley
	Invited to review and provide expert advice on emerging packaging technologies and trends for red meat done in collaboration with Meat and Livestock Australia (MLA) and the RMIT University. Provided expert advice for the Essential Oils and Plant Extracts RD&E Priorities for 2014-2019 for Rural Industries Research and Development Corporation (RIRDC) and the essential oil industry.	Dr Yasmina Sultanbawa

2. National/state/local policy reports and/or industry/government briefings

ANIMAL SCIENCE		
	Invited speaker, presentation entitled "Bacteriophages: An alternative solution for antibiotics", Ridley's technical and applied research team meeting, Gatton, Queensland. Dec 2014	Dr Athol Klieve
	Prepared three monthly reports on Smart Futures Fund Next Gen Beef Breeding Strategies Project for Animal Science, DAF for use in FutureBeef and other State Government Reports. (4 Reports).	Dr Brian Burns
	Provided advice to representative of the Kangaroo Industries Association of Australia on stress assessment in orphaned joeys. Provided information to the American Veterinary Association on the welfare implications of electroimmobilisation of cattle.	Dr Carol Petherick
	Speaker – International Pig Veterinary Society conference. Conny Turni, Reema Singh, Pat Blackall. *Actinobacillus pleuropneumoniae* – The Australian story. Cancun, Mexico. 8-11 June 2014.	Dr Conny Turni
	Advice to the Australian embassy, Dili, Timor Leste: Response to a recommendation for developing a feedlot, abattoir in southern Timor Leste to finish cattle sourced from Australia for high-value domestic markets. Speaker – MLA Meat Profit Day, Dongarra, WA, April 2014. Presentation: 'Cash cow – North Australian beef cow herd production and performance'.	Dr Geoffry Fordyce
	Capacity and Action for Aflatoxin Reduction in Eastern Africa (AusAID Funded Project). Final Report to CSIRO – detailing establishment of diagnostics platform at International Livestock Research Institute in Nairobi (2012-2014).	Dr Mary Fletcher
	Report to Animal Health Australia – 'Old World Screw-worm Fly: Risk of Entry into Australia and Surveillance Requirements'. Beckett S, Spradbery J.P., Urech R., James, P.J. and Green P.E. (2014). 192 pp.	Dr Peter James
	Provided training – DAF Central Queensland Future Beef staff on cattle nutrition and future research priorities, Dec 2014.	Dr Stu McLennan
	Member – steering committee for the Northern Beef CRC development, 3 March 2014. Series of meetings – large beef corporate, to discuss their research program, 20 March and 10 July 2014. Meeting with two leading Queensland graziers to scope research opportunities for beef seedstock enterprise, 23 May 2014. Meeting with MLA to discuss research processes, 18 Sep 2014. Northern Australian Beef Research Committee meeting, 1-2 Dec 2014.	Prof. Stephen Moore
	Industry Engagement – Australian Lot Feeders Strategic planning workshop. Selected participant at the Australian Lot Feeders industry workshop to identify the research, development &	Dr Tim Mahony

	extension priorities for the feedlot sector for the next five years (2015-2020).	
	Speaker – Australian Veterinary Association Meeting in Perth. Presentation: 'Aspects of antimicrobial resistance in the intensive animal industries,' May 2014. Speaker – 10th Asian Pacific Poultry Conference. Jeju Island, Korea. Presentation: 'Infectious coryza – a Review and Update,' 19-23 Oct 2014. Speaker – Pig Health Symposium, Tokyo, Japan. Presentation 'Actinobacillus pleuropneumoniae and porcine pleuropneumonia – an update,' Nov 2014.	Dr Pat Blackall
HORTICULTURE	Invited speaker – Asian Society for Plant Pathology, Chiang Mai, Thailand, 3-6 Nov 2014. Presentation: Research and the management of plant diseases, a case study on bananas. Invited speaker – International Horticultural Congress Brisbane 17-22 Aug 2014, Fruit Abscission in Macadamia Due to Husk Spot Disease. Invited speaker – International Horticultural Congress Brisbane 17-22 Aug 2014. Presentation: Citrus Black Spot Research in Australia (Miles). Invited speaker – International Horticultural Congress Brisbane 17-22 Aug 2014. Presentation: High-resolution melting (HRM) analysis: Using curves to straighten out banana fungal disease diagnostics (Henderson). Invited speaker – International Horticultural Congress Brisbane 17-22 Aug 2014. Presentation: Soil health management is a precursor to sustainable control of *Phytophthora* in macadamia. (Akinsanmi) Invited speaker – International Horticultural Congress Brisbane 17-22 Aug 2014. Presentation: Sustainable Control of Husk Spot of Macadamia by Cultural Practices. (Akinsanmi). Invited by Chinese Academy of Agricultural Sciences in Guangxi to review their research on banana diseases and give invited address: Management of banana diseases in Australia. Invited by the Ecuadorian banana exporters association to give a keynote talk on quarantine pests of banana – an Australian perspective, Oct 2014. Invited presentation at the regional workshop for the development of a continental strategy against the risk introduction of Panama Disease Tropical Race 4 in Latin America, Guayaquil, 14-15 Oct 2014. Dr André Drenth was invited to attend the stakeholder workshop organised under the umbrella of the INREF (Interdisciplinary Research and Education Fund) programme Panama Disease in Banana: Multi-level Solutions for a Global Problem, 6-7 Feb 2014 Davao City, Philippines. This was funded externally to the BPPP.	Prof. André Drenth

	Provision of pathology advice to private company – Macadamia Queen – in Vietnam, concerning disease problems in macadamia orchards. Briefed ACIL Allen concerning review of Horticulture Australia Ltd and the Horticultural levy system. Scientific expert – imports committee of the Australian Banana Growers council. Expert advisor – project with Sugar Research Australia to find the cause of Chlorotic Streak disease. Report – Guangxi Academy of Agricultural Sciences, concerning management of banana diseases. Final report to Horticulture Australia: AP06007– Extension AP05002: *Alternaria* Fruit Spot: New Directions: Final Report, Sydney, Australia: Horticulture Australia Limited. 81pp. Industry report: Soil health and tree decline Australian Macadamia Society News Bulletin 42 (3): 58-60. ISSN 0811-3471. In July 2014, Dr Juliane Henderson and Dr André Drenth travelled to Madang Province, Papua New Guinea as invited guests to observe an inception workshop for an ACIAR project on Bogia Coconut Syndrome (BCS). Dr André Drenth arranged the signing of Memorandum of Understanding between The University of Queensland and the Guangxi Academy of Agricultural Sciences in China to foster closer collaboration and enable exchange of material.	
	Australian Macadamia Society – Macadamia Breeding. Met with Macadamia Industry Varietal Improvement Committee to discuss and make recommendations on potential savings within the industry reference group R&D programs, 13 Feb 2014. Met with Macadamia Industry Varietal Improvement Committee to report on macadamia breeding research, 10 Sep 2014. Speaker – Macadamia Consultant's Meeting, macadamia breeding project, 5 June 2014. Speaker – Australian Macadamia Society Industry Conference, Lismore, 15 Oct 2014. Presentation: "What are the new varieties capable of?" Low Chill Australia Inc. – Peach Breeding. Speaker – Low Chill Australia executive meeting, Gatton, to provide descriptions of elite peach selections, report on novel fruit commercialisation and discuss future grower testing, 15 Jan 2014. Industry field day – Coopers Shoot, NSW to show growers new stone fruit selections, 23 Oct 2014. Speaker – LCA annual general meeting. Bangalow, NSW 16 Dec 2014. Topic was the new breeding selections released for industry evaluation.	Dr Bruce Topp

	Contributed to the development of the avocado industry's "Strategic Investment Plan" related to orchard productivity. Conducted via teleconferences and meetings, April – July 2014. Speaker at four avocado industry field days. 3 April 2014 (Kyogle, NSW), 8 May 2014 (Mt Binga, QLD), 11 June 2014 (Comboyne, NSW), 24 July 2014 (Manjimup, WA). Presentation: "Integrated management of Phytophthora root rot".	Dr Elizabeth Dann
	Speaker – Australasian Plant Virology workshop, Aug 2014. Presentation: Recombination and re-assortment in Banana bunchy top virus. Organiser and speaker – International Horticultural Congress, Promusa Symposium Workshop, Aug 2014. Workshop topic 'Banana streak viruses and their impact on the use of germplasm'. Workshop report for Bioversity International on International Horticultural Congress, Promusa Symposium Workshop, 'Banana streak viruses and their impact on the use of germplasm'.	Dr John Thomas
	Multiple briefings to Horticulture Australia limited on linkages with India. Member of the Horticulture Innovation Australia delegation to India 6 -12 Dec, 2014 to develop collaborative projects with India. Accompanied UQ Vice Chancellor during his visit to India as part of Prime Minister's Delegation to execute the signing of MoU between Indian Council of Agricultural research and the University of Queensland, Sep 2014. Information provided to UQ Vice Chancellor on Bio Clay Technology for his talk on global challenges linked to food and water, Oct 2014.	Dr Neena Mitter
	Speaker – Australian Macadamia Society Conference, Lismore, 14-17 Oct 2014.	Dr Olufemi Akinsanmi
	Solomon Island Government – review of horticultural supply chains and recommendations on key horticultural research investment, 12-24 May 2014. Fiji Government – participation meetings and discussions on Fiji horticultural research priorities, July 2014.	Dr Steven Underhill
	AUSVEG interview – InfoVeg Radio Podcast, an on-line audio website, 'Zeaxanthin-biofortified sweetcorn for macular degeneration', 8 Dec 2014 (to some 4000 industry subscribers).	Dr Tim O'Hare
BROAD-ACRE CROP SCIENCE	Organised/hosted visit of DAF's Acting Director-General, Dr Beth Woods, and Executive Director, Malcolm Letts, to Hermitage Research Facility in my role as centre leader, 21 May 2014. Speaker – AusSORGM on drought adaptation mechanisms in sorghum, 23 July 2014. Organised/hosted visit of DAF's Director-General, Jack Noye, to Hermitage Research Facility, 31 July 2014.	Dr Andrew Borrell

	Hosted/briefed GRDC convener of National Frost Program (Dr Bob Belford) at Hermitage on DAF/QAAFI involvement in frost research, 1 Aug 2014. Speaker – ministerial field day, Kingaroy attended by Hon John McVeigh and the Hon Andrew Cripps, 24 Sep 2014. Organiser and speaker – Stay-green molecular marker workshop for private sector sorghum breeders, 5 Nov 2014.	
	Briefed GRDC Northern Panel Chair and Senior Manager Plant Health – weed management research needs in the northern region, 28 Aug 2014.	Dr Bhagirath-Chauhan
	Invited speaker – GRDC-organised workshop, investigating the potential to breed high temperature tolerant crops, 18-19 Dec 2014. Speaker – Australasian Plant Breeding Conference, 26-29 Oct 2014. Speaker at GRDC-organized workshop investigating the potential to breed high temperature tolerant crops, 18-19 Dec 2014. Invited presentation – Australasian Plant breeding conference attended by researchers and research managers from a range of organizations including DAF and GRDC, 26-29 Oct 2014. Organiser and speaker – annual AusSORGM meeting. This meeting is the peak meeting of Australian sorghum researchers and is attended by scientists from all Australian R&D organizations working on sorghum as well as grain growers and representatives of commercial seed companies, GRDC and DAF, 23 July 2014. Speaker – Stay-green molecular marker workshop for private sector sorghum breeders, 5 Nov 2014. Briefed Senior GRDC managers on aspects of the commercialization of grain sorghum from the core breeding program in Canberra 12 Dec 2014. Spoke at the GRDC/UQ/Commercial seed industry meeting to develop a wheat pre breeding initiative, 17 Nov 2014. Contributed to the organisation and running of the annual meeting of the Australian sorghum midge tested scheme where midge tested ratings for commercial sorghum hybrids are assigned. 11 June 2014. Attended Central Queensland Research advisory committee meeting, 18 March 2014.	Prof. David Jordan
	Briefing – GRDC (northern panel and national program managers) on opportunities for weeds research and heat and drought stress adaptation research in cereals. Briefing – GRDC consultants on performance, progress, and prospects for crop simulation modelling in the Australian Grains Industry. Industry briefing – sorghum RDE, Gatton Cereals Research Field Day, July 2014.	Prof. Graeme Hammer

	Participation in National Cotton Research Strategy Forum hosted by Cotton Innovation Network, May 2014. Briefing – National Grains RDE Strategy Committee on UQ-DAF QAAFI agreement and research progress, Aug 2014. Presentation at forum hosted by CRC for Polymers on research and innovation opportunities in field crop agriculture, March 2014. Invited presentation on modelling technologies to enhance efficiency in molecular breeding at 56th Annual International Maize Genetics Conference, Beijing China, March 2014.	
	Workshop speaker – Grain Cereals Workshop and Field Day, Gatton. Presentation: 'Characterizing cereal growing environments to assist breeding and agronomy', 21 July 2014. Conference speaker – 'Breeding Plants to Cope with Future Climate Change', Leeds, UK. Presentation: 'Breeding for the future: How to adapt to potential impacts of future frost, drought and heat events on Australian wheat?' 16-18 June 2014. Briefed GRDC Northern Panel on drought adaptation research in wheat, 9 Sep 2014.	Dr Karine Chenu
	Briefed local agronomists on wheat pre-breeding activities at the Cereal Agronomy Field Day – Gatton, 21 July 2014. Briefed GRDC Northern Panel – wheat pre-breeding research, 9 Sep 2014. Briefed wheat breeding companies – wheat and barley research, 24 Sep 2014. Hosted – Winter Cereal Research Field Day, Gatton attended by local agronomists, seed companies and breeding companies, 1 Oct 2014	Dr Lee Hickey
	Presentation – Australian Cereal Chemistry Conference, Brisbane 24-27 Aug 2014.	Prof. Robert Henry
	Briefed senior officers at South Australian Research and Development Institute concerning issues relating to the application of biochar to soils.	Prof. Roger Swift
	Invited speaker at the Northern Australia Food Futures Conference, Darwin, Australia. Briefed Australian Mungbean Association about the GrowNorth project and scope for new grain legumes industry in the north, 24 June 2014. Briefed GRDC northern panel about the overview and progress of GRDC pulse agronomy project during their visit to Kingaroy in July 2014. Participated in a round-table discussion involving multi-institutions and private industry stake holders regarding pigeonpea research needs and scoping a pigeonpea project.	Dr Rao (RCN) Rachaputi

FOOD SCIENCE	Invited speaker – Emerging Technologies Summit, Wuhan, China. Main speaker was M Villepin, former Prime Minister of France. Influential audience of high-level Chinese government officials.	Professor Bob Gilbert
	Speaker – Joint Academic Microbiology Seminar Series, Australian Museum, Presentation: "Plant Cell Wall Breakdown in Complex Ecosystems". Sydney, 26 Nov 2014.	Dr Deirdre Mikkelsen
	Briefing to Leigh Henderson, Food Standards Australia New Zealand (15 Aug 2014), regarding poisonous plants in Australia for presentation at International Plant Toxins Forum, Vienna.	Dr Mary Fletcher
	Invited speaker – Food as Medicines Forum 2014, University of Southern Queensland, Springfield Campus, QLD, 3 July 2014. Presentation: Netzel (et al) 'Queen Garnet – A Functional Plum?' Invited speaker – AUSSORGM 2014, O'Reillys, QLD, 23-24 July 2014. Presentation: Netzel (et al) 'Unique sorghum cultivars grown in Australia – characterising their quality traits and phytochemical profiles.' Presentation by Kent Fanning (DAF) at the DAF Regional Leadership Team – South East Meeting, Coopers Plains, QLD, 11 Dec 2014: Fanning (et al) 'SE Region Innovation Grant Case Study #3: Evaluation of consumer acceptability of dark strawberry associated to health profile.' (Joint DAF/QAAFI project team). Queensland Strawberry Growers Association/Queensland Strawberries – Health potential of (QLD grown) strawberries. Meeting at Adrian and Mandy Schultz's strawberry farm, Wamuran QLD, 25 June 2014.	Dr Michael Netzel
	Speaker – ATSE Symposium Sydney, May 2014 'From mining boom to dining boom' on 'Innovation, Science and Technology for the Australian Food Industry'. Speaker – Australasian Milling Industry Conference, July 2014 on 'Recent insights into grain processing for optimising mill and animal performance'. Speaker – Feed Processing Symposium, July 2014, on 'The importance of grain particle size distribution for optimising pig performance'. Speaker – The Royal Agricultural Society of the Commonwealth Conference, Oct 2014 on 'Innovation in Agriculture'.	Prof. Mike Gidley
	Invited speaker – International Horticultural Congress, Brisbane. Presentation: 'Evaluation of packaging films to extend storage life of indigenous Australian vegetables and herbs'. 21 Aug 2014. Panel Speaker – World Food Day native food breakfast, Hillstone, St Lucia, Brisbane. Presentation: 'Native Foods as Functional Ingredients in Food Applications', 16 Oct 2014. Invited speaker – Career progression for Women Graduation Dinner, Toowong Rowing Club, St Lucia. Spoke as participant about my personal learning journey. 12 Nov 2014.	Dr Yasmina Sultanbawa

3. Visitors of national and international profile

ANIMAL SCIENCE		
	Dr Pradeep Malik, Senior Scientist, Animal Nutrition Division, National Institute of Animal Nutrition and Physiology (NIANP), Adugodi, Bangalore, INDIA. Six month visit as an Endeavour Fellow. Delegation from Universidade Estadual Paulista (Brazil), to forge collaborative links in animal science with UQ.	Dr Athol Klieve
	Dr David Johnston and Dr Yuandan Zhang – Animal Genetics and Breeding Unit, Armidale. Mr Tim Schatz – Department of Resources, Northern Territory Government (Primary Industries), NT. Organised for the PNG delegation to visit Droughtmaster (Steve & Claire Farmer, Mount Elsa, Yaamba, Central Qld – Smart Futures Fund Project collaborator) and Brahman BREEDPLAN seedstock herds (Lee Collins, Wandilla, Marlborough, Qld).	Dr Brian Burns
	Delegation from China Institute of Veterinary Drug Control/Centre for Veterinary Drug Evaluation, seeking collaboration on pig health research. Prof. Corinna Kehrenberg – Veterinary School, University of Hannover, Germany, seeking collaboration on pig health research.	Dr Conny Turni
	Timor Leste delegation, including Mr Latino Coimbra (Head of the Department of Ruminant production, Ministry of Agriculture and Fisheries) and Ms Yuliaty Brito, Head of the Department of Animal Production, National University of Timor Leste.	Dr Geoffry Fordyce
	UQ representative – Australia-Latin America, Energy-Water-Food Round Tables. Attended a series of roundtables put together by DFAT and Austrade on a series of three seminars on Energy-Water-Food\sustainability as part of building a high-level government-industry-academia dialogue around common opportunities and linkages between Australia and key Latin American markets. Contributed to a collaborative project between QAAFI and the Universidade Federal de Viçosa (UFV) Minas Gerais (Brazil), studying the genetics of fertility in *Bos indicus* cattle continued through 2014. The first joint UQ-UFV project student, Aline Camporez, was enrolled during 2014. Ms Camporez submitted her first conference paper to the World Congress on Genetics Applied to Livestock Production. She also completed the requirements for confirmation of PhD candidature in Nov 2014. An additional visiting student within the same project, (Mayara Morena) also commenced work within QAAFI during Nov 2014.	Dr Mathew Kelly
	Prof. Arício Linhares, Entomology and Parasitology, Department of Animal Biology, University of Campinas, Brazil. Mr and Mrs P Bolster, Principals, P Guinane Pty Ltd, Cudgeon NSW. P Guinane is a privately owned company involved in the development of novel tea tree oil products. The company grows and produces tea tree oil for export.	Dr Peter James

	Mr Des Rinehart, Manager, Feedlot R&D Project Manager, Meat & Livestock Australia. Dr Ben Callaghan, Portfolio Manager, Horticulture Australia Ltd. Mr Geoff Lindon, Program Manager, Productivity and Animal Welfare. Australian Wool Innovation.	
	Delegation from Colombia, Feb 2014. Contributed to a collaborative project between QAAFI and the Universidade Federal de Viçosa (UFV) Minas Gerais (Brazil), studying the genetics of fertility in *Bos indicus* cattle continued through 2014. Delegations – Sao Paulo State University (UNESP) and University of Viçosa, Brazil to discuss research collaboration with The University of Queensland.	Prof. Stephen Moore
	Delegations – Sao Paulo State University (UNESP) and University of Viçosa, Brazil to discuss research collaboration with The University of Queensland. Dr Jose Manuel Zorrilla Rios – leading researcher from Mexico, to discuss research findings and trends in marketing of cattle in northern Australia. Mr Stewart Peters – Director of Projects, Integrated Food and Energy Developments (IFED), to advise on possible QAAFI involvement in research in the Etheridge Integrated Agriculture Project.	Dr Stu McLennan
	Dr Praveen Gupta – Principal Scientist, Veterinary Biotechnology Division, Indian Veterinary Research Institute, India. A world-leading expert in viral diseases and vaccine development for cattle and other ruminants.	Dr Tim Mahony
	Delegation from China Institute of Veterinary Drug Control/Centre for Veterinary Drug Evaluation seeking collaboration on pig health research. Prof Corinna Kehrenberg – Veterinary School, University of Hannover, Germany – seeking collaboration on pig health research. Dr Kylie Hewson, Manager, Food Safety Program – Australian Egg Corporation Ltd – discussions on possible future funding.	Dr Pat Blackall
HORTICULTURE	Dr Miquel Dita – Embrapa Cassava & Fruits. Brazilian Agricultural Research Corporation (EMBRAPA). Dr Lisa Keith – (International Research Collaborator) Tropical Crop and Commodity Protection Research United States Department of Agriculture (USDA/ARS) 64 Nowelo St. Hilo, HI 96720, USA. Dr Toshiro Shigaki – National Agricultural Research Institute (NARI) PNG, Discussion of research strategies to investigate bogia coconut syndrome in PNG. Dr Juan-Fernado Aguilar – Honduras Foundation for Agricultural Research.	Prof. André Drenth

	Dr Fred Bakry – CIRAD (Agricultural Research for Development), France. Dr Edson Amorim – Brazilian Agricultural Research Corporation (EMBRAPA), Brazil. Dr Chih-Ping Chao – Taiwan Banana Research Institute (TBRI), Taiwan. Dr Nguyen Minh Chau – former Director, Southern Fruit Research Institute (SOFRI), Vietnam. Dr Megan Dewdney – citrus pathologist, The University of Florida.	
	Dr Stephane Blanc – Plant-Virus-Insect Interactions Research Group Leader, Joint Research Unit, Cirad, Montpellier, France.	Dr Andrew Geering
	Dr Graciela da Rocha Sobierajski, International Society for Horticultural Science winner Miklos Faust award for young pomologist, visited our peach and macadamia breeding team at the Maroochy Research Facility, Nambour. Aug 2014. Mr Stefano Foschi, plant breeder with Crop Production Research Centre (Po Valley, Italy) and University of Bologna, Italy visited 21 Aug to 17 Dec 2014.	Dr Bruce Topp
	Dr Cameron Peace – Washington state University. Discussed ongoing and future collaborations with international Rosaceae DNA informed breeding activities.	Dr Craig Hardner
	Dr Evelynes Costes and Dr Pierre Eric Lauri – lead researchers in tree horticulture from INRA in France. Dr Frederic Normand – mango physiology and agronomy researcher from CIRAD, Reunion, France. Dr Mary Lu Arpaia – horticulture specialist, UC Riverside, Kearney Agricultural Research & Extension Center, USA.	Dr Jim Hanan
	Dr Arvind Varsani – University of Canterbury (two visits, Jan and May 2014), world authority on identity and diversity of DNA viruses. Ongoing collaboration on Australian legume and banana crops, and grasses. Mr Davi Junghans – pineapple breeder from Brazilian Agricultural Research Corporation, which runs one of the world's major pineapple breeding programs. Dr Jim Lorenzen – senior program officer, Bill & Melinda Gates Foundation, for discussions on potential project collaborations on banana virus research.	Dr John Thomas
	Prof. Vandana Paratvale – Professor of Pharmaceutics, Department of Pharmaceutical Sciences and Technology, Institute of Chemical Technology, Mumbai, Maharashtra, India. A/Prof. Subash Varma – Department of Veterinary Microbiology, Himachal Pradesh, India. Simon Mason – Business Development Manager, Animal Health Division, Benchmark Holdings, UK.	Dr Neena Mitter

	Prof. Nk Singh – National Professor, B.P. Pal Chair, National Research Centre for Plant Biotechnology, New Delhi, India. Prof. AK Singh – Head of the Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi, India. Dr Asokan – Principal Scientist (Agricultural Entomology), Division of Biotechnology, Indian Institute of Horticultural Research, Bangalore, India. Dr YTN Reddy – Principal Scientist, Horticulture, Indian Institute of Horticultural Research, Bangalore, India. Mary Lu Arpaia – Extension Subtropical Horticulturist, Department of Botany and Plant Sciences University of California, Riverside, USA. Dr David Kuhn, Research Molecular Biologist, USDA-ARS Subtropical Horticultural Research Station, Miami, Florida, USA. Dr Neeti Sanan Mishra – Staff Research Scientist, Plant Molecular Biology, International Center for Genetic Engineering and Technology, New Delhi, India.	
	Dr Elliot W. Kitajima – Professor, Department of Phytopathology, University of São Paulo, Brazil. Dr Marilyn Roossinck – Professor in Virus Evolution, Pennsylvania State University, USA. Dr Colleen M. Higgins – on sabbatical from Auckland University of Technology, New Zealand.	A/Prof. Ralf Dietzgen
	Mr Shalendra Prasad – Team Leader, Fiji Ministry of Agriculture, Tropical Fruit Crops Program. Dr Siosiua Halavatau – Coordinator, Pacific Regional Crop Production, Secretariat of the Pacific Community (SPC), specialists in tropical crops and food security.	Dr Steven Underhill
BROAD-ACRE CROP SCIENCE	Dr Clarisse Barro-Kondombo – sorghum breeder, INERA, Burkina Faso, Feb 2014. Dr Rachael Kamene Kisulu – sorghum breeder, Kenya Agricultural Research Institute, Kenya, Feb 2014. Dr Mohammed Yousif Balla – sorghum breeder, Agricultural Research Corporation, Sudan, Feb 2014. Dr Bob Belford – national convener of GRDC's Australian Frost Program, 1 Aug 2014. Dr Justin Weinheimer – United Sorghum CheckOff Program (Texas, USA), an organisation that disperses grower levies to US researchers, 28-29 Aug 2014. Dr Vivienne Anthony – Senior Advisor, Syngenta Foundation, Switzerland, 15 Oct 2014. Dr Gabrielle Persley – Project Director, Crawford Fund and Global Change Institute, 15 Oct 2014. Dr Denis Blight – Chair, Crawford Fund, 15 Oct 2014.	Dr Andrew Borrell

	Ms Melanie King – Program Director Food Systems, Deputy Director, Global Change Institute, 15 Oct 2014. Mr Adam Harper – Communication and Engagement Manager, Global Change Institute, 15 Oct 2014.	
	Hosted visit of Dr He Yingbin, a research scientist who was subsequently appointed as a QAAFI adjunct, May 2014.	Dr Andries Potgieter
	Prof. Steve Powles – Australian Herbicide Resistance Initiative (AHRI), University of Western Australia, Perth, Australia, 14-15 July 2014. Discussed weed management issues and their possible solutions.	Dr Bhagirath-Chauhan
	Dr Mulugetta Mekuria – Leader of the Sustainable Intensification of Maize and Legumes program for International Maize and Wheat Improvement Center. Rob Taylor – visit of members of the GRDC northern panel. Steve Wilson, Trevor Phillip – breeders and agronomists from DuPont Pioneer and Pacific Seeds. Victor Sadras – Prof. at University of Adelaide and South Australian Research and Development Institute.	Dr Daniel Rodriguez
	Professor Mitch Tuinstra – Purdue University, 4 Aug 2014. Mr Errol Corsan – Global Breeding Leader for Sorghum, Sunflower and Canola Nuseed, California USA, Australia, 4 July 2014. Dr Justin Weinheimer – Crop Improvement Program Director, National Sorghum Checkoff program USA, 21-31 July 2014. Ian Small – Chief Investigator, Plant Energy Biology, ARC Centre of Excellence UWA, 9 July 2014. Dr Hannes Dempwolf – Crop Diversity Trust, Hermitage Research Station, 20 Aug 2014. Sorghum scientists from Germany and France including: Prof. Rod Snowdon and Wubishet Bekele – Justus-Leibig University, Giessen, Germany. Dr Eugene Diatloff (Institut National de la Recherche Agronomique, INRA) at Go8 DAAD sorghum workshop Brisbane, Hermitage research Station and annual sorghum research group meeting, 23 July – 1 Aug 2014. Dr Justin Weinheimer Crop Improvement Program Director of the Sorghum Check off program USA (grower funded R&D agency for sorghum in the USA). Arranged meetings for Justin with senior management and scientists of GRDC, QAAFI DAF and UQ. 21-31 Oct 2014.	Prof. David Jordan
	A/Prof. David Lobell – Department of Environmental Earth System Science, Deputy Director, Center on Food Security and the Environment, Stanford University, USA. David made a sabbatical visit Jan–June 2014 to progress research on crop-climate interactions.	Prof. Graeme Hammer

	Dr Wayne Powell – Chief Scientific Officer, CGIAR. Prof. Steve Powles – Director Australian Herbicide Resistance Initiative (AHRI), University of Western Australia, Perth. Dr Justin Weinheim – Program Manager, United Sorghum Checkoff Program (Texas, USA), an organisation that disperses grower levies to US researchers, Texas, USA. Dr Rob Snowdon – Chair of Plant Breeding, Department of Agronomy and Plant Breeding, Justus Liebig University, Giessen, Germany. Dr Mitch Tuinstra – Wickersham Chair of Excellence in Agricultural Research, Professor of Plant Breeding and Genetics, Department of Agronomy, Purdue University, USA. Dr Ian Dodd – Lancaster Environment Centre, Lancaster University, United Kingdom. Dr Vivienne Anthony – Senior Scientific Officer, Syngenta Foundation for Sustainable Agriculture. Dr Shenggen Fan – Director General, International Food Policy Research Institute, Washington DC, USA.	
	Dr Greg Rebetzke – CSIRO program leader, High Performance Crops for Australia, ACT. Dr Pierre Casadebaig – INRA modeller, Toulouse, France. Associate Professor Victor Sadras – expert in adaptation of crops to biotic and abiotic stresses, SARDI, South Australia.	Dr Karine Chenu
	Dr Reg Lance – Barley Breeder for Intergrain, Western Australia Dr Andrew Milgate, Cereal pathologist – NSW Department of Primary Industries	Dr Lee Hickey
	Mr Tim Lust – CEO of the United Sorghum Checkoff Program (Texas, USA), an organisation that disperses grower levies to US researchers, Texas, USA. Mr Errol Corsan – Global Breeding Leader for Sorghum, Sunflower and Canola Nuseed, Victoria, Australia. Delegation from Kansas State University, which included Prof. Dirk Maier (Department of Grain Science and Industry director, International Grains Program), USA. Ambassador of the United States of America to Australia, His Excellency, Mr John Berry. Consul General USA, Hugo Llorens. Vice Admiral Ray Griggs AO, Chief of Navy, Royal Australian Navy. Dr Shenggen Fan – Director General of the International Food Policy Research Institute in Washington. Mitr Phol, Thailand – sugarcane research opportunities.	Prof. Robert Henry
	Visiting scientist – Prof. M H B Hayes, University of Limerick, Ireland	Prof. Roger Swift

	Mr Philip Moore – Managing Director, Biotel Ltd., Malaysia Mr Andrew Jackson – CEO, Australian Peat Technologies	
	GRDC northern panel, 10 Sep 2014. Viv Anthony (Syngenta) – Gabriel Persley and Melanie King (Global Change Institute), 14 Oct 2014. Prof Sheila Okoth, School of Biological Sciences, University of Nairobi	Dr Rao (RCN) Rachaputi
FOOD SCIENCE	Visiting scientist – Professor Rosa Lamuela, Department of Nutrition, School of Pharmacy, Universitat de Barcelona. Aug 2014. Visiting scientist – Professor Gonzalo Gonzalez Mateos, Department of Animal Science, Universidad Politecnica de Madrid. Aug 2014. Prof. Lluis Serr – Director of the Nutrition Group, Universidad de Las Palmas de Gran Canaria. May 2014.	Dr Eugeni Roura
	Prof. Sheila Okoth – University Of Nairobi, Kenya to discuss project development mycotoxins in peanuts and other crops. Jagger Harvey – Biosciences Eastern And Central Africa, International Livestock Research Institute, Nairobi – to discuss approved funding for new DFAT funded aflatoxin project in Kenya. Leigh Henderson – Food Standards Australia New Zealand. Discussion for presentation at International Plant Toxins Forum in Vienna.	Dr Mary Fletcher
	Prof. Michael Rychlik – Head of the Chair of Analytical Food Chemistry and of the R&D Division of the Bioanalytics Department at the Technical University Munich ('University of Excellence), Germany (Joint Nutrition Society of Australia/QAAFI Scientific Seminar about assessing folate bioavailability in humans, 25 March 2014; two-day workshop at UQ for UQ/QAAFI & DAF students/staff about the use of Stable Isotope Dilution Assays (SIDA) in Food and Nutrition Science, 24-25 Aug 2014).	Dr Michael Netzel
	Prof. Christophe Courtin – Katholiek Universitat, Leuven, Belgium. International expert on cereal quality and nutrition. Prof. Yong-Cheng Shi – Kansas State University. International expert on starch chemistry and properties. Prof. Jeya Henry – Singapore Institute for Clinical Sciences. Clinical and nutritional properties of foods. Prof. Markus Pauly – University of California (Berkeley). International expert on plant fibres.	Prof. Mike Gidley
	Prof. Paul Bernstein – University of Utah, USA. Macular carotenoids researcher and Convenor of the International Carotenoid Symposium. Prof. Elizabeth Jeffery – University of Illinois, USA. Glucosinolate research group.	Dr Tim O'Hare

	Prof. Michael Rychlik – University of Technology Munich, Germany. Analytical food chemistry research group. Dr Carolyn Lister – Plant and Food Research, New Zealand. Functional foods research. Prof. Bhimu Patil – Texas A&M University, USA. Functional foods research group (Citrus). Prof. Olaf van Kooten – Wageningen University, Netherlands. Dr Marie-Josephe Amiot – University of Aix-Marseille (France). Prof. Yves Desjardins – University of Laval (Canada). Polyphenol research group and bioavailability. Dr Trevor George – University of Northumbria. Sports medicine researcher (United Kingdom). Prof. Marie Olsson – Swedish University of Agricultural Sciences (Sweden). Dr Gustavo Teixiera – Universidade Estadual Paulista (Brazil), Acai functional food research. Dr Carol Wagstaff – University of Reading (United Kingdom) Prof. Steve Schwartz – University of Ohio, USA (tomato and glucosinolate research group).	
	Prof. Sheila Okoth – School of Biological Sciences, University of Nairobi. A Mycology expert, Prof. Okoth visited our labs at Coopers Plains in April/May 2014. She was awarded a grant through the Australian-Africa Universities Network (AAUN) – Partnership Research & Development Fund 2013. Prof. Dharini Sivakumar – Tshwane University of Technology, South Africa. Expertise in post-harvest disease management in fruits and vegetables. Signing of MOU with Crops for the Future Research Centre (CFRC), which is a part of the global Crops for the Future which works in collaboration with the University of Nottingham in Malaysia and the Government of Malaysia. CFRC is looking at the use of underutilized plant species to improve nutritional security through breeding, production agroprocessing and marketing in dietary diversification.	Dr Yasmina Sultanbawa

4. Membership of national and international professional committees

ANIMAL SCIENCE		
	A/Prof Ala Lew-Tabor and Dr Manuel Rodriguez Valle were both invited 'scientific committee members' for the first joint conference of the Society for Tropical Veterinary Medicine (STVM-12) and Ticks and Tick-borne Pathogens (TTP-8), Cape Town (South Africa), 24–29 Aug 2014.	Dr Ala Lew-Tabor
	Chairman – Genetics & Animal Breeding Sub-Committee, Australian Cattle Veterinarians. Member – Australian Veterinary Association Litmus Panel 2014-2015. Invited Member – National Droughtmaster Stud Breeder's Society R&D Committee. Member – North-West Queensland Regional Beef Research Committee.	Dr Brian Burns
	Member – Scientific Program Planning Committee, International Symposium on the Nutrition of Herbivores and the International Symposium on Ruminant Physiology joint conference, 2014. Member – Australian Society for Microbiology. Member – Australian Society of Animal Production. Academic Editor – PLOSone.	Dr Athol Klieve
	Co-Editor-in-Chief and Editorial Board member of Applied Animal Behaviour Science (published by *Elsevier*). Member – Steering Committee of the National Animal Welfare RD&E Strategy. Member – National and International Awards Committee of the International Society for Applied Ethology (ISAE). Member – Organising Committee for the applied ethology symposium at the International Ethological Conference (Cairns, 9-14 Aug 2015).	Dr Carol Petherick
	Member – Australian Society for Microbiology.	Dr Conny Turni
	Registered Veterinary Surgeon – Queensland.	Dr Geoffry Fordyce
	Scientific Committee Member – Sheep Genetics Australia Technical Committee Member.	Dr Mathew Kelly
	Member – Chicken Meat Research and Development Advisory Committee. Overseeing research projects funded by chicken meat industry. Member – Organising Committee, International Pasteurellaceae Conference 2014, Prato 2014. Editor – Journal of Veterinary Diagnostic Investigation. Member – Editorial Board, Journal of Clinical Microbiology.	Dr Pat Blackall

	Member – Editorial Board, Avian Diseases. Member – Editorial Board, Veterinární Medicína.	
	Member – National ParaBoss Technical Committee, which leads the development of recommendations for national sheep parasite control practices, identifies research, communication and extension needs and oversees the technical aspects of administration of the ParaBoss suite of websites.	Dr Peter James
	Member – Central Queensland Beef Research Committee. Associate Editor – Animal Production Research (the national scientific journal in this subject area). Member – Editorial Advisory Board, Animal Feed Science and Technology (a European scientific journal focussing on animal nutrition).	Dr Rob Dixon
	Academic Editor – *BMC Genetics* International Society for Animal Genetics (member of the executive). International Advisory Committee – EU FP7 project 'Ruminomics'.	Prof. Stephen Moore
	Treasurer – Organising Committee for the 8th International Workshop on Modelling Nutrient Digestion and Utilisation in Farm Animals, Cairns 2014. Chair – Harry Stobbs Memorial Trust Fund.	Dr Stu McLennan
	Member – Department of Agriculture, Fisheries and Forestry Institutional Biosafety Committee. Member – Editorial Board, *Virus Genes* (international scientific journal).	Dr Tim Mahony
HORTICULTURE	Member – technical advisory board. Investigacion e Innovacion Technologica en Palma de Aceite (CENIPALMA) Colombia. Member – Advisory Committee. World Phytophthora Collection. UC California. Chair – Finance Committee. Australasian Plant Pathology. Editor – Tropical Plant Pathology. Associate Editor – *Persoonia.* Member – American Plant Pathology Society. Member – Australasian Plant Pathology. Member – Australian Macadamia Society (AMS). Member – Australian Society for Horticultural Science (AuSHS).	Prof. André Drenth
	2014 chairperson – *Caulimoviridae* study group of the international committee on taxonomy of viruses. This committee oversees virus taxonomy and nominates new taxa.	Dr Andrew Geering
	Scientific Committee member – Breeding section, International Horticultural Congress.	Dr Bruce Topp

	Scientific Advisory Committee member – 15th Australasian Plant Breeding Conference.	
	Member – Australian Macadamia Conservation Committee.	Dr Craig Hardner
	Member – Australasian Plant Pathology Society, International Society for Horticultural Science, International Society of Plant Pathology. Senior Editor – *Australasian Plant Pathology* (a peer reviewed scientific journal).	Dr Elizabeth Dann
	Member – scientific committee: X International Symposium on Modelling in Fruit Research and Orchard Management, Montpellier, France 2-5 June 2015.	Dr Jim Hanan
	Associate Editor – *European Journal of Plant Pathology.* Chair – International Committee on Taxonomy of Viruses, *Nanoviridae* Working Group. Chair – Bioversity International, Musanet Conservation Thematic Group. Organiser – International Horticultural Congress/Bioversity International Promusa Symposium Workshop on Banana streak viruses. Member – Organising Committee, Second Workshop on *Musa* Germplasm: identification towards optimising use, Trichy-India, Bioversity International.	Dr John Thomas
	Academic Editor – *Plos ONE*, Open access peer reviewed journal, Impact Factor 4.1. Associate Editor – *Phytopathology*, premier international journal of fundamental research in plant Pathology, American Phytopathological Society, Impact factor 2.75. Co-convenor – Australia India vaccine for development session at the International Nano-Bio Conference, Brisbane, July 2014 Convenor – Australia-India horticulture linkages workshop, Brisbane, 2014.	Dr Neena Mitter
	Editorial board member – *European Journal of Plant Pathology*	Dr Olufemi Akinsanmi
	Chair – International Committee on Taxonomy of Viruses (ICTV) *Nyamiviridae* Study Group. Member – ICTV *Rhabdoviridae* Study Group. Member – ICTV *Mononegavirales* Study Group. Chair – Organising Committee, 11th Australasian Plant Virology Workshop, Brisbane, 2014. Editor – *Archives of Virology*.	A/Prof. Ralf Dietzgen
	Member – Organising Committee, 9th Conference of the Asian Federation for Information Technology in Agriculture 2014 -ICT's	Dr Steven Underhill

	for future Economic and Sustainable Agricultural Systems, Western Australia. Member – Technical Working Group (U-TWG) for the Food Waste and Loss Protocol, World Resources Institute, Washington 2014. Editor – *Horticulturae* Journal, Basel, Switzerland.	
	Convenor & organising committee member/ scientific committee member of International Horticultural Congress, FAVhealth2014 (Symposium 1).	Dr Tim O'Hare
BROAD-ACRE CROP SCIENCE	Member – Weed Science Society of America (WSSA). Member – International Plant Protection Congress (IPPC). Editor-in-Chief – *Crop Protection* (Elsevier). Associate Editor – *Weed Science* (Weed Science Society of America). Chief Editor, *Recent Advances in Weed Management*, Springer Publications.	Dr Bhagirath-Chauhan
	Member – Advisory Group of Conservation Farmers Inc. Toowoomba Australia. Editor – Agricultural Systems (Elsevier). Manager or journal articles submitted to Agricultural SystemsMember – organising committee, Fifth International Farming Systems Design Conference (Montpellier, France).	Dr Daniel Rodriguez
	Member – Scientific Advisory Committee, NCRIS Australian Plant Phenomics Facility (APPF). Member – Scientific Advisory Committee, European Plant Phenomics Network (EPPN). Member – Scientific Advisory Board, EU AMAIZING Project (Breeding for economically and environmentally sustainable maize varieties: an integrated approach from genomics to selection). Chair – joint CSIRO-DAF-UQ APSIM Initiative Steering Committee (www.apsim.info) to oversee development and manage application of the APSIM farming system simulation platform.	Prof. Graeme Hammer
	Member – Wheat Initiative Expert Working Group on Crop and Plant Modelling.	Dr Karine Chenu
	Member – Crawford Fund Queensland Committee	Dr Lee Hickey
	Member – national steering committee overseeing use of trace elements in the Australian grains industry.	Dr Mike Bell
	Member – Agriculture and Climate Change Amsterdam Scientific Advisory Committee. Member – International Plant Molecular Biology Congress, Brazil Scientific Committee. Organiser – PAG Sequencing Complex Genomes Workshop. Organiser – PAG Sugarcane Genome Sequencing Workshop. Organiser – PAG Climate Resilient Crops Workshop.	Prof. Robert Henry

	Member – DivSeek (Global Trust) Management Committee Associate Editor – *Tropical Plant Biology*. Chair – TropAg 2015. UQ Committees – Adjunct and Honorary Appointments, Gatton Campus, Infrastructure Sub Committee. Review Committee – UQ Sustainable Minerals Institute. ATSE Representative – Agricultural Biotechnology Council Of Australia (ABCA). Member – Agricultural Biotechnology Council of Australia (ABCA) Scientific Experts Committee. Steering committee – Grow North. Member – Bioenergy RD & E Advisory Forum. Member – Feedstocks Technical Working Group. Agriculture Forum Member – Australian Academy of Technological Sciences and Engineering. Forum is comprised of more than 100 fellows and other experts involved in local and international agriculture and food related research and industry.	
	Member – Executive Committee and Council of the International Union of Soil Science. Senior Advisor – Organising Committee of the 20th World Congress of Soil Science held in Jeju, South Korea.	Prof. Roger Swift
	Member – Australian Society of Plant Scientists Member – American Peanut Research and Education Society	Dr Rao (RCN) Rachaputi
FOOD SCIENCE	Chair – International Union of Pure & Applied Chemistry Working Party on Critically evaluated techniques for size separation characterisation of starch. Member – Editorial Board, Carbohydrate Polymers (major international journal). Member – Editorial Board, Food Science & Human Wellness (new international journal).	Prof. Bob Gilbert
	Treasurer – Australian Society for Microbiology.	Dr Deirdre Mikkelsen
	President (as of 12/2014) – Australasian Association for ChemoSensory Science (AACSS). Previously vice president. Member – Standards Australia National Committee FT-022 – Sensory Analysis of Food. Chair – Organising Committee, Brisbane 2014 Annual Meeting of the AACSS. Organising Committee – 17th International Symposium on Olfaction and Taste (Yokohama, 2016). Scientific Advisory Board – biotech company, Omnia Molecular S.L. Expert member – European Food Safety Authority	Dr Eugeni Roura

	Co-chair – Organizing Committee, Digestive Physiology of Pigs 2018. Invited guest editor – special issue, *Animal Feed Science and Technology*.	
	Secretary – Australian Barley Technical Symposium Inc. Methods sub-committee – Institute of Brewing & Distilling – Asia Pacific Section. Brewing Science Group – European Brewery Congress.	Dr Glen Fox
	Chair – Analytical and Environmental group, Qld Branch, Royal Australian Chemical Institute. President Elect – Qld Branch, Royal Australian Chemical Institute.	Dr Mary Fletcher
	Organiser & host – NSA-QLD branch Annual Scientific Seminar at Coopers Plains (last Seminar, 15 Aug 2014). Member – Local Organising Committee of the 6th International Symposium on Human Health Effects of Fruits and Vegetables, Brisbane, 17-22 Aug 2014. Editorial Board Member – *Food Research International* (Elsevier). Handling Editor – *Journal of Food Composition and Analysis* (Elsevier).	Dr Michael Netzel
	Member – Editorial Board for 'Carbohydrate Polymers', an international journal devoted to scientific and technological aspects of industrially relevant polysaccharides. Member – Editorial Board for 'Food & Function', an international journal devoted to linking the chemistry and physics of food with health and nutrition. Organiser – 64th Australian Cereal Chemistry Conference, Aug 2014. Organiser – 4th Australian Institute of Food Science and Technology Summer School, Jan 2014. Member – Organising Committee for conference series 'Food Structure, Digestion and Health' – conference to be held in Wellington NZ, Oct 2015.	Prof. Mike Gidley
	Member – Queensland committee, Crawford Fund (since 2011)	Dr Yasmina Sultanbawa

5. Media events or any other media profile

ANIMAL SCIENCE		
	Future Beef presentation, "Queensland gut microbes go international".	Dr Athol Klieve
	Television interview with Mr Tom Hartley, Journalist, Seven Network (Operations), Rockhampton, 3 Feb 2015. (i) Genetic Outcomes from CRC for Beef Genetic Technologies; (ii) Background and outcomes to date on Smart Futures Fund Next Gen Beef Breeding Strategies Project; and (iii) General overview of current situation of Northern Australian Beef Industry and strategies to improve industry productivity and profitability.	Dr Brian Burns
	Dehorning – ABC Radio, Bush Telegraph, 20 March 2014	Dr Carol Petherick
	Episode of 'Food Bowl', Australia Network (ABC), Sep 2014 – Beef cattle production research in Timor Leste. North Queensland Register – Cattle given free choice in Burleigh Station supplementation trial, 30 Oct 14. *Queensland Country Life* – Animal welfare at forefront, 27 Aug 2014. *Queensland Country Life* – Gauze helps with dehorning healing, 26 Aug 2014. ABC National Rural News – QAFFI vet Dr Geoffry Fordyce is working on a breeding cattle production program here in Australia as well as Timor-Leste, 5 June 2014. *Weekly Times* – Rethink after scrotum study, Feb 2014. Farm Weekly, 8 May 2014, P.18 MEAT PROFIT DAY A HUGE SUCCESS "… with a unique chance to pose industry questions to the panel comprising … Geoffry Fordyce, Queensland Alliance for Agriculture and Food Innovation." North Qld Register, 11 Dec 2014, P.17 SPYGLASS FACILITY WELCOMES TWO NEW TECHNICAL OFFICERS While at UQ, Nicholas was the recipient of a 2014 Winter Research Scholarship, which enabled him to secure a placement working for Queensland Alliance for Agriculture and Food Innovation (QAAFI) at DAF's Brian Pastures Research Facility near Gayndah.	Dr Geoffry Fordyce
	Feed Back Magazine – 'Stopping screwworm at the border', Aug 2014, pp 26-27.	Dr Peter James
	Presentation, MLA industry breakfast – 'Optimising beef cattle growth paths in northern Australia – what's profitable?' 2 April 2014.	Dr Stu McLennan

	Qld Country Life, 21 Aug 2014, P. 111 UQ PROJECT: MICROALGAE FOR CATTLE FEED, BIODIESEL "UQ, including the Queensland Alliance for Agriculture and Food Innovation, has worked closely with Meat and Livestock Australia and Xstrata Technology to establish this pilot algae farm," Mr McVeigh said.	
HORTICULTURE	'Wild rice key to global food security' – ABC Rural Radio, 24 June 2014.	Dr Andrew Geering
	ABC Radio – Genetic improvement of macadamia, Oct 2014 Fresh Plaza – Nectacots show great potential in Australia, Jan 2014. http://www.freshplaza.com/article/131902/Nectacots-shows-great-potential-in-AU	Dr Bruce Topp
	Display at Qld launch of National Science Week – Brisbane Convention Centre. Display featuring wild populations of macadamia and effect of roasting intensity on characteristics of macadamia. Display at Moo baa Munch – Toowoomba field day organised by Agforce. Display featuring wild populations of macadamia and effect of roasting intensity on characteristics of macadamia.	Dr Craig Hardner
	High Country News – Avocados – The quiet achievers $40 million a year contributor to the economy, 27 May 2014.	Dr Elizabeth Dann
	Industry article: Wilkie JD and Hanan J (2014) The small tree-high productivity initiative – aiming to transform tree crop production. *Australian Macadamia Society News Bulletin*, 42(3): 74-77. Industry article: Wilkie JD and Hanan J (2014) The Small Tree – High Productivity Initiative, aiming to transform. *Talking Avocados*, Spring 2014 Issue: 24-27. Paper presented: White N, Hanan J. A Model of Macadamia with Application to Pruning in Orchards. International Horticultural Congress, Brisbane 21 Aug 2014. QAAFI media release: "Sweet Success for QAAFI Scientists" announcing successful ARC Discovery grant for Christine Beveridge and Jim Hanan. Includes mention of the Small Tree High Productivity Initiative with quotes from our project team members. Nov 2014.	Dr Jim Hanan
	BioClay Technology for Crop Protection: *South Burnett Times* – Naturally effective clay used to control pests, 23 Aug 2014. QAAFI media release – Bioclay solution to growing challenge for agriculture, 6 Aug 2014. Nanovaccines: Towards next generation nanovaccines, Journalists.medianet.com.au *Future Beef* – Nanovaccines for improved animal health, 5 Feb 2014. MOU Indian Council of Agricultural Research and the University of Queensland	Dr Neena Mitter

	Deccan Chronicle, India - India, 'Australia sign MoU on agriculture', 5 Sep 2014. Video Release – India, Australia sign MoU on Agriculture. Multiple media releases in India and Australia, covering the signing of MoU. Qld Country Life, 7 Aug 2014, P.2 STOP PRESS "UQ'S Queensland Alliance for Agriculture and Food Innovation has been awarded a $498,000 Queensland Government grant to develop a non-toxic spray for combating crop pathogens and pests. A research team led by QAAFI's Associate Professor Neena Mitter, in collaboration with UQ's Associate Professor Gordon Xu, expects to develop a radically new delivery system that stands to revolutionise control of crop pests."	
	Radio UQ – Rhabdoviruses and related pathogens in agriculture, Dec 2014.	A/Prof. Ralf Dietzgen
	AUSVEG Interview for Ausveg Audio website – Zeaxanthin-biofortified sweetcorn for macular degeneration, 8 Dec 2014. *Queensland Country Life* – Sweet-corn's supergold future, 1 Jan 2014. ABC Radio National – *Bush Telegraph* – 'Corn, not carrots helps eyesight', 28 April 2014. *The West Australian* – 'Sweet-corn can halt blindness', 22 May 2014. *Australasian Science Magazine* – 'Hybrid corn slows macular degeneration', 1 April 2014. *The Australian* – 'Scientist sees corn protecting eyesight', 24 April 2014. *Farming Ahead* – 'Sweet-corn could slow eye disease', 31 Jan 2014 Talking Nutrition on Twitter (@DSM Nutrition) – 'Pathways to lutein and zeaxanthin differ in sweetcorn', 3 July 2014. *The Source* magazine – 'Biofortified vegetables could increase life expectancy', 26 Aug 2014. AUSVEG – Infoveg Radio Podcast, Dec 2014.	Dr Tim O'Hare
BROAD-ACRE CROP SCIENCE	Generation Challenge Program (GCP Media) Interview. Bangkok, Thailand. Interview on developing drought-adapted germplasm for Africa and Australia, 8 Oct 2014. Media interview with UQ's Global Change Institute on the science underpinning food security, focusing on partnerships between Australian and African scientists, 15 Oct 2014. *South Burnett Times*. Drought adaptation in sorghum: local and global perspectives. Linked to a Ministerial Field Day at Kingaroy on 24 Sep 2014, published 15 Oct 2014.	Dr Andrew Borrell

	Media Associated with Hermitage Research Facility Schools 2014 Plant Science Competition (AKB is Centre Leader at Hermitage and a member of the organising committee for this event). DAF Media Release, Minister for Agriculture, Fisheries and Forestry The Honourable John McVeigh, 'Competition gives students the bug for ag-science'. (Hermitage Research Facility Schools Plant Science Competition) 2 April 2014. Win TV news coverage, Hermitage Research Facility Schools Plant Science Competition, 2 April 2014. *Toowoomba Chronicle* (front page). Hermitage Research Facility Schools Plant Science Competition, 3 April 2014. *Warwick Daily News* (Bush Telegraph), 'Bugs on science agenda'. Hermitage Research Facility School's Plant Science Competition, 23 April 2014. *Warwick Daily News*, Prize for winning bug. Hermitage Research Facility Schools Plant Science Competition, 12 Sep 2014. Farming's Future Website, Competition gives students the bug for ag-science. Hermitage Research Facility Schools Plant Science Competition, 10 April 2014. Australian Agricultural College Corporation website, Bug attack! Hermitage Research Facility Schools Plant Science Competition, 16 June 2014. National Science Week website, Awards Day – 2014 DAF Hermitage Schools Plant Science Competition, 19 Aug 2014. *Warwick Daily News* – Bush Telegraph, Kids' minds keep science alive. Hermitage Research Facility Schools Plant Science Competition, 26 Aug 2014. *Townsville Bulletin*, Bug Attack project reaps rewards. Hermitage Research Facility Schools Plant Science Competition, 26 Aug 2014.	
	Sorghum outlook published in *Rural Weekly* – Central Queensland, Rockhampton, 10 Jan 2014.	Dr Andries Potgieter
	Queensland Country Life – Tactical agronomy for maize and sorghum (interview). *Ecos* magazine – interview and article on sustainable intensification of agriculture.	Dr Daniel Rodriguez
	Contributed to national opening of the ARC centre of excellence for photosynthesis and associated media and promotional activity, 24 Oct 2014 20 Jan 2014, North West Magazine, P.7 HEAT RAISES CONCERN OVER SORGHUM CROP Sorghum Plant Breeder and Team Leader of the Queensland Alliance for Agriculture and Food Innovation at Warwick's Hermitage Research Facility, Dr David Jordan, said while the yield impacts of moisture stress particularly around flowering and grain	Prof. David Jordan

	filling were well recognised, recent research highlighted the implications heat stress for pollen viability. Dalby Herald, 21 Nov 2014, P.4 GROWERS NEED TAILORED COURSES The government will work with the Queensland Alliance for Agriculture and Food Innovation to increase sorghum yields and drought and insect resistance.	
	Radio interview – ABC Local Radio, Brisbane on new ARC Centre of Excellence for Translational Photosynthesis, Nov 2014. Panellist – public forum with Chief Scientist Prof. Ian Chubb at new CoE opening (ANU Canberra) to discuss how innovations and research collaborations in photosynthesis research could be an important part of the solution to global food security, Oct 2014. QAAFI Media Release – 'UQ scientists help unlock the secrets of photosynthesis', 24 Oct 2014 UQ News Media Release – 'UQ scientists help unlock the secrets of photosynthesis', 24 Oct 2014	Prof. Graeme Hammer
	Article in GRDC publication *Ground Cover*, 'Frost curbs early sowing in the north', May 2014. Radio interview on improving wheat yield under water-limitation ABC Rural, Oct 2014.	Dr Jack Christopher
	Feature article – 'Focus on research: northern winter cereal breeding', GRDC Ground Cover Magazine, 20 Jan 2014. Feature article – 'Speed breeding wheat to tackle root lesion nematodes', GRDC Ground Cover Magazine, 3 Feb 2014 Feature segment – Network Ten's Scope, 'Super Wheat', 21 Aug 2014 Hosted – Winter Cereal Research Field Day, Gatton, which communicated the latest research in wheat and barley in Queensland, attended by representatives from local newspapers, radio and magazines, 1 Oct 2014 Feature article – 1 March 2014, Farming Ahead SPEED BREEDING IN SPACE RACE FOR RESISTANCE Geneticists from the Queensland Alliance for Agriculture and Food Innovation (QAAFI) have refined the technology since its first trials a decade ago at The University of Queensland (UQ). PHOTO STORY – Qld Country Life, 13 March 2014, P. 23 University of Queensland geneticist Lee Hickey has identified a gene that will protect barley from the damaging disease, leaf rust.	Dr Lee Hickey
	Video feature on Denitrification for Ground Cover TV episode 13. Articles on phosphorus and potassium research in cotton in Spotlight magazine in the winter 2014 and (in draft) for summer 2014–15.	Dr Mike Bell

	Factsheets for the grains industry on Soil testing for crop nutrition (Northern Region – Jan 2014) and on Denitrification – Reducing potential N loss, March 2014. Articles in *Groundcover* magazine and the *Groundcover* supplement (More Profit from Crop Nutrition) in Jan-Feb 2014. Denitrification – the latest chapter in the N story *Groundcover* pp 38-39. Nutrition research tackles modern issues – *Groundcover Supplement*, p4. Deep soil tests reveal northern nutrient deficiencies – *Groundcover Supplement* p9-10. Interpreting soil test results for the northern region – *Groundcover Supplement* p11. Article in *Pulse Update Annual* Feb 2014. Reviving subsoil fertility pp 30-31. Article in *Australian Grain* (Northern Focus) Fertilizer placement and changing farm practices pp 4-6. Presentation as part of a webinar titled 'Emissions from Cropping Systems – can practice change to reduce emissions enhance profitability?' conducted as part of the Carbon Farming Initiative activities led by the Burnett Mary Regional Group. My specific talk was titled 'Minimising emissions in grains cropping systems'. Qld Country Life, 16 Jan 2014, P. 19 SOILS HAVE DEEP NEED Shallow testing is presenting a rosier picture of soil fertility than is really the case, according to University of Queensland principal research fellow Mike Bell. Stock & Land, 23 Jan 2014, P. 23 SOIL TESTING CONCERN Shallow testing is presenting a rosier picture of soil fertility than is really the case, according to University of Queensland principal research fellow Mike Bell. Rural Weekly, 24 Jan 2014, P. 9 LOOKING TO LEGUMES Legumes offer a partial solution to the issues of increasing fertiliser costs and nutrient deficiency plaguing many northern farms, according to University of Queensland principal research fellow Mike Bell. Rural Weekly (Rockhampton), 21 Feb 2014, P. 19 NUTRIENT ADVICE SET TO PROFIT CROP FARMERS Dr Mike Bell, who heads the soils and farming systems research team at UQ's Queensland Alliance for Agriculture and Food Innovation, addresses growers at last week's More Profit from Crop Nutrition II field walk at Wondalli, Goondiwindi.	

	The Land, P.63, 20 March 2014 PHOTO STORY – Grains Update Draws Farmers David Lester, Department of Agriculture Fisheries and Forestry (DAF), Toowoomba … and Dr Mike Bell, Queensland Alliance for Agriculture and Food Innovation (QAAFI). Clifton Courier, 25 June 2014, P.6 SOIL TESTING, FUNDAMENTAL FOR PHOSPHORUS MANAGEMENT "Dr Mike Bell of the University of Queensland's Alliance for Agriculture and Food Innovation (QAAFI), said that soil testing is important to understanding the status of these key nutrients, of which native stocks in the soils have been run down over time." Lightning Ridge News, 26 June 2014, P.11 GRAIN GROWERS ADVISED TO TEST THEIR SOIL "Dr Mike Bell of the University of Queensland's Alliance for Agriculture and Food Innovation (QAAFI), said that soil testing is important to understanding the status of these key nutrients, of which native stocks in the soils have been run down over time." Qld Country Life, 4 Dec 2014, P.19 NAROW ROW, THE WAY TO GO The trials on his block are funded through the Grains Research and Development Corporation's Queensland Pulse Agronomy Initiative, which involves collaboration between Department of Agriculture Fisheries (DAF) and the Queensland Alliance for Agriculture and Food Innovation (QAAFI). Qld Country Life, 4 Sep 2014, P.25 SOIL GIVES UP ITS SECRETS His property is hosting trials being conducted by the Queensland Alliance for Agriculture and Food Innovation principal research fellow in agronomy and farming systems, Dr Mike Bell.	
	Nature – 'Agribiotechnology: Blue-sky rice' editorial feature about the untapped potential of ancient wild rice breeds that grow in northern Australia, Vol 154, 30 Oct 2014. ABC Radio National – Rice and coffee research stories. Television news stories about coffee genome research on Networks Seven, Ten and Two, Sep 2014. Mexico Global Food and Agriculture Conference. The Conversation – 'Giant steps needed to build up northern Australia's potential', 13 June 2014. Cairns Post, 11 June 2014, P.12 CAPE'S WILD RICE A GENETIC GOLDMINE Queensland Alliance for Agriculture and Food Innovation director Professor Robert Henry said the wild rice populations represented an invaluable source of diversity, supporting the security of one of the world's most important food commodities.	Prof. Robert Henry

	Gatton Lockyer Brisbane Valley Star, 30 July 2014, P.36 RESEARCH VISION IS FOR EXCELLENCE "Speaking at a grower workshop at UQ Gatton last week, QAAFI director Professor Robert Henry said the large and complex international research project was recognition of QAAFI's ability to play a key role in world-class agriculture research." Rural Weekly Insert, 1 Aug 2014, P.3 CRÈME OF THE CROP FOR STUDY "Speaking at a grower workshop at UQ Gatton last week, QAAFI director Professor Robert Henry said the large and complex international research project was recognition of QAAFI's ability to play a key role in world-class agriculture research." Food Australia, 1 Sep 2014, P.7 WILD RICE COULD SOLVE GLOBAL HUNGER "In research led by Professor Robert Henry from UQ's Queensland Alliance for Agriculture and Food Innovation (QAAF), scientists have identifies gaps they call 'genome deserts' in the inherited components or DNA of Australian wild rice." Courier Mail, 6 Sep 2014, P.3 (General News) FARMERS FROTHING OVER NEW BEAN FIND "Potentially, Queensland could develop a multi-million dollar market for high-quality, premium coffees, ranging from full strength to decaffeinated," said Prof Henry, of Queensland's Alliance for Agriculture and Food Innovation." Courier Mail, 6 Sep 2014, P.15 DECAF DISCOVERY FILL OF BEANS "Potentially, Queensland could develop a multi-million dollar market for high-quality, premium coffees, ranging from full strength to decaffeinated," said Prof Henry, of Queensland's Alliance for Agriculture and Food Innovation." Weekend Post, 6 Sep 2014, P.16 (General News) TASTE OF A BIG FUTURE "Potentially, Queensland could develop a multi-million dollar market for high-quality, premium coffees, ranging from full strength to decaffeinated," said Prof Henry, of Queensland's Alliance for Agriculture and Food Innovation." Qld Country Life, 18 Sep 2014, P.35 ZERO-CAF COFFEEE FOR QLD "Professor Robert Henry at UQ's Queensland Alliance for Agriculture and Food Innovation (QAAFI) said this was one outcome of an international research effort analysing the coffee genome. It should soon be possible to select and grow coffee with a predetermined level of caffeine – ranging from zero-caf to jump-start," he said.	
	Journal article – 'Are Soil and Fertiliser Resources Sufficient for Our Food Security', *FOCUS*, Australian Academy of Technological	Prof. Roger Swift

	Science and Engineering (Issue 182, Feb, 2014 addressing Food Security).	
	"Regional Pulse Agronomy Projects' for *Pulse Australia* magazine. Management impacts on N fixation of mungbeans and chickpeas. GRDC *Advisor update*, 5-7 March 2014, Goondiwindi, Australia. Effect of peanut-shell biochar soil amendment on the performance of peanut on two types of soils in south-east Queensland. 20th World Congress of Soil Science, 8-13 June 2014, Korea. Genotypic variation for resource use efficiency in chickpea grown under subtropical dryland environments in Australia. 6th International Food Legumes Conference, 6-11 July 2014, Saskatoon, Canada. Impact of row spacing and plant populations on chickpea, GRDC updates, Warra and Condamine, Aug 2014.	Dr Rao (RCN) Rachaputi
FOOD SCIENCE	Featured on page three of *People's Daily* in China	Prof. Bob Gilbert
	TV (Network 10) – Diversity of taste sensitivity in humans, TV program SCOPE Channel 11 (broadcast scheduled for June 2014). TV (Network 10) – meat flavours and satiety for TV program SCOPE Channel 11 (broadcast 15 May 2014). Regular food and nutrition related contributions to journalists mostly through unrecorded phone conversations.	Dr Eugeni Roura
	UQ/QAAFI media release – 'Beer quality is no froth and bubble', generating two radio interviews (4BC & ABC Drive), story covered on "The project" (Channel 10) and broadcast on 29 affiliates, dozens of newspapers (nationally). 19 Feb 2014, Weekly Times, P.85 DROUGHT PROOF BARLEY IN SIGHTS OF RESEARCHERS Researchers at UQ's Queensland Alliance for Agriculture and Food Innovation have identified a characteristic known as stay -green traits in certain barley varieties. Feature article – 13 March 2014, Qld Country Life, P. 23 BARLEY FACES UP TO CLIMATE CHANGE CHALLENGE Researchers at the University of Queensland's (UQ) Queensland Alliance for Agriculture and Food Innovation (QAAFI) have identified stay-green characteristics in types of barley that could lead to the production of tougher, drought-proof plants.	Dr Glen Fox
	QAAFI media release on research on coffee genome: 'Zerocaf, jumpstart or in between? A barista's world just got more complicated' resulted in news reports on Network Ten, Network Seven, ABC News, Radio 4KQ, and ABC Science Online, 5 Sep 2014. World food day – native foods meets agribusiness, 16 Oct 2014.	Dr Heather Smyth
	Feature article – 1 May 2014, P. 13 2014 AIFST SUMMER SCHOOL	Dr Mary Fletcher

	Food safety applications on Near Infrared Spectroscopy for aflatoxin detection in maize was presented (Titilayo Falade, The University of Queensland, Qld).	
	Orchard Day at Warroo – Queen Garnet: a high antioxidant/anthocyanin plum. Update for growers, industry, Qld State Government (Ministers McVeigh and Springborg) and media about the current Queen Garnet plum research activities (organised by Kent Fanning, DAF). The Good Rich Fruit Company, Warroo, QLD, 17 Jan 2014. Follow-ups in 'ABC QLD Country Hour', 20 Jan 2014; 'QLD Country Life', 23 Jan 2014 and '*Fruit and Vegetable News*', April 2014. DAF Intranet News – Dark Strawberry 'Superfruit' set to boost the market, 12 Sept 2014.	Dr Michael Netzel
	Australian Pork Newspaper, 1 June 2014, P.7 GIANG ATTACK ON GRAIN PARTICLE SIZE GIANG Nguyen … is 'an AusAID scholar and a PhD student at the University of Queensland under Dr Peter Sopade's Pork CRC Project'.	Dr Peter Sopade
	ABC Rural's *Country Hour* – interview with Dr Sultanbawa, Ms Helen Jenkins, Australian Prawn Farmers Association and Ann Shanley of Kindred Spirit Foundation who was representing the Palngun Wurnangat Women's Association processing Kakadu plums in Wadeye, Darwin in the Northern Territory. The interview was conducted by Ms Robin McConchie ABC *Country Hour* Producer. 16 Oct 2014. ABC Rural also broadcasted on 16 Oct 2014 a recording of Rus Glover, Director, ANFIL and Dr Yasmina Sultanbawa entitled: 'World Food Day, a time to recognise the value of bush tucker' by Robin McConchie. Sultanbawa, Y. 2014. 'Nutritional and health benefits of Australian native plant foods' in *The Outback Chef*, edited by Jude Mayall. New Holland Publishers Pty Ltd, Sydney, Australia, ISBN 978 1742575452.	Dr Yasmina Sultanbawa

6. Departmental or Ministerial Advices provided

ANIMAL SCIENCE		
	Growth and condition score targets for breeding cattle on DAF research stations, Aug 2014.	Dr Geoffry Fordyce
	Verbal briefing (beef and R&D links with South America) – roundtable discussion with the Federal Trade Minister (Andrew Robb) and departmental advisers, 12 Dec 2013.	Dr Mathew Kelly
HORTICULTURE		
	Prediction of performance of new macadamia selections used to inform state minister of progress from macadamia breeding.	Dr Craig Hardner
	Briefing to DAF Queensland on MOU between Queensland and Department of Biotechnology, Ministry of Science and Technology, India. Organised Australia-India Business Council sponsored dinner event to promote linkages with India in the area of Animal Health and Qld DAF.	Dr Neena Mitter
BROAD-ACRE CROP SCIENCE	Briefing with DAF's Acting Director-General, Dr Beth Woods, and Executive Director, Malcolm Letts, on infrastructure development at Hermitage Research Facility, 21 May 2014. Briefing with DAF's Director-General, Jack Noye, on infrastructure development at Hermitage Research Facility, 31 July 2014. General briefing with Ministers McVeigh and Cripps on drought adaptation in cereals, field day, Kingaroy, 15 Oct 2014. Personal briefing with Minister McVeigh on the challenge of producing more food with less water in Queensland, field day, Kingaroy, 15 Oct 2014.	Dr Andrew Borrell
	Provided support and information for DAF staff for the GRDC audit of the sorghum core breeding program, 4 June 2014.	Prof. David Jordan
	Briefing on QAAFI Grains R&D at Ministers Grain Industry Roundtable, Toowoomba – Nov 2014.	Prof. Graeme Hammer
	Presentation of research highlights – Grains Roundtable with Minister John McVeigh, Dr Beth Woods, Prof. Sagadevan Mundree, Mr James Clark (GRDC) and representative from GrainCorp at DAF, Tor Street, Toowoomba 18 Nov 2014.	Prof. Robert Henry
	Personal briefing with local MP member about the need for more dryland pulse crop options for South Burnett. Assisted Pulse Australia in preparing a Business case on 'pigeonpea' for GRDC. Assisted DAF senior managers in preparing a project proposal on pigeonpea.	Dr Rao (RCN) Rachaputi

7. Number and types of new or improved technologies published

Animal science		
	Genome sequence data for Australian strains. Barrero, R. A., Moolhuijzen, P., Indjein, L., Venus, B., Keeble-Gagnère, G, Power, J., Bellgard, M.I., Lew-Tabor, A.E. (2014) Draft Genome Sequences of Campylobacter fetus subsp. venerealis bv. venerealis Strain B6 and bv. intermedius Strain 642-21. *Genome Announcements*, 14 Oct 2;2 (5). pii: e00943-14. doi: 10.1128/genomeA.00943-14. Novel methods for in vitro cattle tick feeding. Lew-Tabor, A.E., Bruyeres, A.G., Zhang, B., Rodriguez Valle, M. (2014) Rhipicephalus (Boophilus) microplus tick in vitro feeding methods for functional (dsRNA) and vaccine candidate (antibody) screening. *Ticks and Tick Borne Diseases,* 5:500-510. New method to differentiate anaplasma marginale strains in collaboration with Washington State University and DAF tick fever centre. Aguilar Pierlé, S., Imaz-Rosshandler, I., Akim Kerudin, A., Sambono, J., Lew-Tabor, A., Rolls, P., Rangel-Escareño, C., Brayton, K.A. (2014) Genetic diversity of tick-borne rickettsial pathogens; Insights gained from distant strains. *Pathogens* 3(1), 57-72. Doi: 10.3390/pathogens3010057.	Dr Ala Lew-Tabor
	Burns et al. (2014) published a report on 'Male indicator traits to improve female reproductive performance' (MLA Final Report, B.NBP 036, ISBN: 9781925045963, Feb 2014) that reported heritability and genetic correlation estimates for a number of new male reproductive performance traits and also some preliminary genetic correlations between male and female reproductive traits for use in selection programs in tropical beef cattle breeds. Team member of a McGowan et al. (2014) led North Australian Beef Fertility Project: Cash Cow (MLA Final Report, B.NBP.0382, ISBN: 9781925045840, January, 2014 and World Buiatrics Congress Paper, Cairns, Australia, 27 July - 1 Aug 2014) that: ▪ Reported new scientific knowledge developed on risk levels of herd reproductive performance; ▪ Demonstrated how producers can readily and accurately determine how their breeding herd is performing; ▪ Demonstrated why some breeding mobs achieve expected levels of performance whilst other do not; ▪ Demonstrated why some breeding females readily become pregnant after calving and wean a calf while others take much longer to become pregnant or fail to wean a calf. Team member of a M. R. S. Fortes et al. (2014) led tropical beef cattle project (Andrology, 2014, 2 (3) 370-378) that identified that 'sperm protamine deficiency correlates with sperm DNA damage in Bos indicus bulls' and subsequently results low reproductive performance in these bulls. Team member of a R. Xiang et al. (2014) led tropical beef cattle project (ISAG 2014 and *Journal of Bone and Mineral Research*,	Dr Brian Burns

	2014, doi:10.1002/ jbmr.2263) that identified 'widespread differential maternal and paternal genome effects on foetal bone phenotype at mid-gestation' that can have important effects on growth patterns in cattle. Team member of a G. Fordyce et al. (2014) led tropical beef cattle project (Theriogenology (2014) 81: 805–812) that reported on the comparative 'scrotal circumference of Australian beef bulls' and the impact of scrotal circumference on subsequent bull fertility. Team member of a D. Menzies et al. (2014) led tropical beef cattle project (Digital Rural Futures Conference. Keppell, M. & Reushle, S., University of Southern Queensland: Australia, pp. 44-45) that reported on a 'Northern Australia Reproduction Group – A New Approach to an Age-Old Profit Problem' strategy to improve reproductive performance in northern Australian beef cattle herds. As a member of the National Droughtmaster Stud Breeder's Society R&D Committee, I was involved in the development of National $Indexes for important commercial markets for Droughtmaster breeders. These $Indexes are subsequently used by BreedObject which is a software tool for use with BREEDPLAN, which is a National Genetic Improvement Program. It assists in optimising the design/development of beef-breeding programs by calculating the optimum mix of Estimated Breeding Values (EBVs), that is, reproduction, growth and carcass traits EBVs etc., for any given breeding situation. The program is designed for stud and commercial breeders in making selection decisions.	
	Barros-Rodriguez, M., C.A. Sandoval-Castro, J. Solorio-Sanchez, L.A. Sarmiento-Franco, R. Rojas-Herrera and A.V. Klieve. 2014. *Leucaena leucocephala* in ruminant nutrition. *Tropical and Subtropical Agroecosystems*. 17: 173-183. Godwin S., A. Kang, L-M. Gulino, M. Manefield, M-L. Gutierrez-Zamora Jimenez, M. Kienzle, D. Ouwerkerk, K. Dawson and A.V. Klieve. 2014. Investigation of the microbial metabolism of carbon dioxide and hydrogen in the kangaroo foregut by stable isotope probing. *ISME Journal*. 8:1855-1865. Barros-Rodríguez, M.A., F.J. Solorio-Sánchez, C.A. Sandoval-Castro, A.V. Klieve, R.A. Rojas-Herrera, E.G. Briceño-Poot and J.C. Ku-Vera. 2014. Voluntary Intake, Rumen Protein Degradation Kinetic and In Vitro Gas Production in Sheep Consuming Leucaena. Joint ISNH ISRP international conference, Canberra, ACT, September, 2014. Animal Production in Australia, Vol. 30; Proc. *Australian Society of Animal Production*. 30: 191. Le, O.T., D.M. McNeill, A.V. Klieve, P. Dart, D. Ouwerkerk, B. Schofield, and M. Callaghan. 2014 Probiotic Bacillus amyloliquefaciens Strain H57 Improves the Performance of Pregnant and Lactating Ewes Fed a Diet Based on Palm Kernel Meal. Joint ISNH ISRP international conference, Canberra, ACT, September, 2014. Animal Production in Australia, Vol. 30; Proc. *Australian Society of Animal Production.* 30: 319.	Dr Athol Klieve

	Petherick JC, Small AH, Mayer DG, Colditz IG, Ferguson DM & Stafford KJ (2014). A comparison of welfare outcomes for weaner and mature *Bos indicus* bulls surgically or tension band castrated with or without analgesia. 1. behavioural responses. *Appl Anim. Behav*. *Sci*. 157, 23-34. Petherick JC, Small AH, Mayer DG, Colditz IG, Ferguson DM & Stafford KJ (2014). A comparison of welfare outcomes for weaner and mature *Bos indicus* bulls surgically or tension band castrated with or without analgesia. 2. responses related to stress, health and productivity. *Appl Anim. Behav. Sci*. 157, 35-47.	Dr Carol Petherick
	New Technologies: Published paper on new methodology for determining antimicrobial resistance in Haemophilus parasuis. (Dayao, D.A.E., Gibson, J.S., Blackall, P.J., Turni, C., 2014. Antimicrobial resistance in bacteria associated with porcine respiratory disease in Australia. *Veterinary Microbiology*, 171, 232 – 235). Published paper on a novel DNA-based methodology to type *Actinobacillus pleuropneumoniae* (Turni, C., Singh, R., Schembri, and M. Blackall, P.J. (2014) Evaluation of a multiplex PCR to identify and serotype Actinobacillus pleuropneumoniae serovars 1, 5, 7, 12 and 15. Lett Appl Microbiol, 59: 362 -369). New knowledge to industry: Published paper on epidemiology of fowl cholera (Singh R, Blackall PJ, Remington B, Turni C. (2014) Epidemiology of Fowl Cholera in Free Range Broilers. *Avian Diseases* 58, 124 - 128). Published paper on antibiotic resistance of Australian pig respiratory pathogens (Dayao, D.A.E., Gibson, J.S., Blackall, P.J., Turni, C., 2014. Antimicrobial resistance in bacteria associated with porcine respiratory disease in Australia. *Veterinary Microbiology*, 171, 232 – 235).	Dr Conny Turni
	The BRICK. Contributor to Low-input beef business analytical spreadsheet to measure primary indices of profitability, cattle productivity, and cattle performance. Available from DAF, Qld. System for evaluating beef breeding herd productivity and performance against what is achievable in a specific situation – Final report for MLA-sponsored Cash Cow project.	Dr Geoffry Fordyce
	Morgan, J.A.T. and Urech. R (2014), An improved real-time PCR assay for the detection of old world screwworm flies. *Acta Tropica* 138, s76-81.	Dr Jess Morgan
	Azevedo, C. F., F. F. Silva, M. D. V. de Resende, M. S. Lopes, N. Duijvesteijn, S. E. F. Guimarães, P. S. Lopes, M. J. Kelly, J. M. S. Viana, and E. F. Knol. 2014. Supervised independent component analysis as an alternative method for genomic selection in pigs. Journal of Animal Breeding and Genetics 131: 452–461. Boddhireddy, P., M. J. Kelly, S. L. Northcutt, K. C. Prayaga, J. Rumph, and S. DeNise. 2014. Genomic Predictions in Angus Cattle:	Dr Mathew Kelly

Comparisons of sample size, response variables, and clustering methods for cross-validation. *J. Anim. Sci* 92: 485-497.

Connolly, S., M. Fortes, E. Piper, J. Seddon, and M. Kelly. 2014. Determining the number of animals required to accurately determine breed composition using genomic data Proceedings, 10th World Congress of Genetics Applied to Livestock Production, Vancouver.

Crispim, A. C., F. R. Fonseca, M. Kelly, M. R. S. Fortes, S. E. F. Guimaraes, P. S. Lopes, and S. S. Moore. 2014. Genome Wide Association for growth curve parameters in Brahman cattle Proceedings, 10th World Congress of Genetics Applied to Livestock Production, Vancouver.

Guimarães, S. E. F., L. L. Verardo, F. F. Silva, M. Kelly, M. S. Lopes, J. Bastiaansen, P. S. Lopes, and E. Knol. 2014. Candidate genes network for number of teats in pigs Proceedings, 10th World Congress of Genetics Applied to Livestock Production, Vancouver.

Kelly, M. J., M. R. Fortes, R. K. Tume, and J. M. Thompson. 2014. Whole genome association study of fatty acid composition and fat quantity in a diverse range of beef cattle breeds. *J. Anim. Sci* 92: 1895-1901.

Kelly, M. J., and J. Thompson. 2014. Estimating the economic value of using a panel of tenderness markers to select for improved consumer palatability scores Proceedings, 10th World Congress of Genetics Applied to Livestock Production, Vancouver.

Lyons, R. E., N. T. Loan, L. Dierens, M. R. S. Fortes, M. Kelly, S. McWilliam, Y. Li, R. J. Bunch, B. E. Harrison, W. Barendse, S. A. Lehnert, and S. S. Moore. 2014. Evidence for positive selection of taurine genes within a QTL region on chromosome X associated with testicular size in Australian Brahman cattle. *BMC genetics* 15: 6.

Porto-Neto, L., M. R. S. Fortes, M. Kelly, S. A. Lehnert, and A. Reverter. 2014. A Gene Network Inferred from Genome-wide Association: Prioritization of QTLs Associated with Tropical Cattle Reproduction Proceedings, 10th World Congress of Genetics Applied to Livestock Production, Vancouver.

Ramayo-Caldas, Y., M. R. Fortes, N. J. Hudson, L. R. Porto-Neto, S. Bolormaa, W. Barendse, M. Kelly, S. S. Moore, M. E. Goddard, S. A. Lehnert, and A. Reverter. 2014. A marker-derived gene network reveals the regulatory role of PPARGC1A, HNF4G and FOXP3in intramuscular fat deposition of beef cattle. *J Anim Sci*.

Strucken, E. M., B. Gudex, M. H. Ferdosi, H. K. Lee, K. D. Song, J. P. Gibson, M. Kelly, E. K. Piper, L. R. Porto-Neto, S. H. Lee, and C. Gondro. 2014. Performance of different SNP panels for parentage testing in two East Asian cattle breeds. *Anim Genet.*

Swan, A. A., D. J. Brown, H. D. Daetwyler, B. J. Hayes, M. Kelly, N. Moghaddar, and J. H. J. van der Werf. 2014. Genomic Evaluations in the Australian Sheep Industry Proceedings, 10th World Congress of Genetics Applied to Livestock Production, Vancouver.

	Recommendations on the best prophylactic and therapeutic compounds for use in a containment and eradication program in the event of an exotic incursion. (See: James PJ April Wardhana AH, Brown GW and Urech RE (2014) Chemical containment and eradication of screw−worm incursions in Australia. Final Report to Meat and Livestock Australia. Project B.NBP.0488 (May 2014) (http://www.mla.com.au/Research-and-development/Search-RD-reports/RD-report-details/Animal-Health-and-Biosecurity/Chemical-containment-and-eradication-of-screwworm-incursions-in-Australia/195).	Dr Peter James
	Godwin, R. M. and Morgan, J. A. T. (2014), A simple, one-tube assay for the simultaneous detection and diagnosis of ten Australian poultry Eimeria. *Electrophoresis*. 35(4): 494-502 doi: 10.1002/elps.201300286.	Dr Rosie Godwin
	Published paper justifying the inclusion of *mycoplasma bovis* in the diagnostic methods for bovine respiratory disease to improve management of this disease which results in losses between $60-100 million annually in the beef industry (see Horwood, P.F., Schibrowski, M.L., Fowler, E.V., Barnes, T.S., Mahony, T.J. (2014) Is *Mycoplasma bovis* a missing component of the bovine respiratory disease complex in Australia? *Australian Veterinary Journal*. 92:6,185). Published new methodology for improving the identification of factors that increase or decrease the risk of feedlot cattle developing bovine respiratory disease, knowledge of this factors facilitates better management to reduced economic losses associated with this disease (see Hay, K.E., Barnes, T.S., Morton, J.M., Clements, A.C.A., Mahony, T.J. (2014) Risk factors for bovine respiratory disease in Australian feedlot cattle: Use of a causal diagram-informed approach to estimate effects of animal mixing and movements before feedlot entry. *Preventative Veterinary Medicine*. 117(1): 160-169. doi:10.1016/j.prevetmed.2014.07.001). New vaccine technology based on nanotechnology published. The technology demonstrated the capacity to generate strong immune responses to vaccine components of a virus which causes significant losses in the beef industry (see Mody, K., Mahony, D., Zhang, J., Cavallaro, A.S., Zhang, B., Popat, A., Mahony, T.J., Yu, C., Mitter, N. (2014) Silica vesicles as nanocarriers and adjuvants for generating both antibody and T-cell mediated immune responses to Bovine Viral Diarrhoea Virus E2 protein. *Biomaterials*. 09/2014; DOI: 10.1016/j.biomaterials.2014.08.044).	Dr Tim Mahony
	Published paper on new methodology for determining antimicrobial resistance in *Haemophilus parasuis*. (see 'Use of a proposed antimicrobial susceptibility testing method for *Haemophilus parasuis.*' *Veterinary Microbiology* 172:586-589). Published paper on a novel DNA-based methodology to type *Actinobacillus pleuropneumoniae* (See 'Evaluation of a multiplex PCR to identify and serotype *Actinobacillus pleuropneumoniae*	Dr Pat Blackall

	serovars.' 1, 5, 7, 12 and 15. *Letters in Applied Microbiology* 59, 362-369). Published paper on novel DNA typing methods for *Mannheimia haemolytica*. (see 'Use of REP-PCR and 16S rRNA gene sequencing for comparison of *Mannheimia haemolytica* isolates obtained from fatal cases of bovine respiratory disease in the United States and Australia.' *Australian Veterinary Journal* 92:15-23).	
	Meira, CT; Farah, MM; Fortes, MRS; Moore, SS; Pereira, GL; Silva, JAV; da Mota, MDS; Curi, RA. A Genome-Wide Association Study for Morphometric Traits in Quarter Horse JOURNAL OF EQUINE VETERINARY SCIENCE Volume: 34 Issue: 8 Pages: 1028-1031 Published: AUG 2014 Ramayo-Caldas, Y., Fortes, M.R.S., Hudson, N.J., Porto-Neto, L. R., Bolormaa, S., Barendse, W., Kelly, M., Moore, S.S., Goddard, M.E., Lehnert, A., Reverter, A. (2014) A marker-derived gene network reveals the regulatory role PPARGC1A, HNF4G and FOXP3in intramuscular fat deposition of beef cattle. J Anim. Sci. Published online before print April 28, 2014, doi:10.2527/jas.2013-7484 Fortes, M.R.S., Suhaimi, A. H.M.S., Porto-Neto, L.R., McWilliam, S.M., Flatscher-Bader, T., Moore, S.M., D'Occhio, M.J., Meira, C.T., Thomas, M.G., Snelling, W.M., Reverter, A., Lehnert, S.A. (2014) Post-partum anoestrus in tropical beef cattle: A systems approach combining gene expression and genome-wide association results. Livestock Science http://dx.doi.org/10.1016/j.livsci.2014.06.017 Karisa, B., Moore, S., Plastow, G. (2014) Analysis of biological networks and biological pathways associated with residual feed intake in beef cattle. Animal Sci. J. 85: 374-387. Karisa, B.K, Thomson, J., Wang, Z., Li, C., Montanholi, Y., Miller, S.P., Moore, S.S., Plastow, G.S. (2014) Plasma metabolites associated with residual feed intake and other productivity performance traits in beef cattle. Livestock Science http://dx.doi.org/10.1016/j.livsci.2014.03.002 Miar, Y., Plastow, G.S., Moore, S.S., Manafiazar, G., Charagu, P., Kemp, R.A., Van Haandel, B., Huisman, A.E., Zhang, C.Y., McKay, R.M., Bruce, H.L., Wang, Z. (2014) Genetic and Phenotypic Parameters for Carcass and Meat Quality Traits in Commercial Crossbred Pigs. J. Anim. Sci doi: 10.2527/jas.2014-7685 Omana, D.A., Goddard, E., Plastow, G.S., Janz, J., Ma, L., Anders, S., Moore, S.S., Bruce, H.L. (2014) Influence of on-farm production practices on sensory and technological quality characteristics of pork loin. Meat Science 96: 316-320. Zhang, C.Y., Wang, Z., Bruce, H.L., Janz, J., Goddard, E., Moore, S., Plastow, G.S. (2014) Associations between single nucleotide polymorphisms in 33 candidate genes and meat quality traits in commercial pigs. Animal Genetics Article first published online: 7 APR 2014 DOI: 10.1111/age.12155 Akanno, E.C., Plastow, G., Woodward, B.W., Bauck, S., Okut, H., Wu, X.L., Sun, C., Aalhus, J.L., Moore, S.S., Miller, S.P., Wang, Z., Basarab, J.A. (2014) Reliability of molecular breeding values for	Prof. Stephen Moore

	Warner-Bratzler shear force and carcass traits of beef cattle-An independent validation study. J. Anim. Sci. Published online before print May 6, 2014, doi:10.2527/jas.2013-7374 Abo-Ismail, M.K., Vander Voort, G., Squires, J.J., Swanson, K.C., Mandell, I.B., Liao, X., Stothard, P., Moore, S., Plastow, G., Miller, S.P. (2014) Single nucleotide polymorphisms for feed efficiency and performance in crossbred beef cattle. BMC Genetics 15:14. Lyons, R.E., To Loan, N., Dierens, L., Fortes, M.R.S., Kelly, M., Mcwilliam, S.M., Li, Y., Bunch, R., Harrison, B.E., Barendse, W., Lehnert, S.A., and Moore, S.S. (2014). Evidence for positive selection of taurine genes within a QTL region on chromosome X associated with testicular size in Australian Brahman cattle. BMC Genetics 15.	
HORTICULTURE	A bead-based suspension array for the multiplexed detection of begomoviruses and their whitefly vectors. Sharon van Brunschot, Jan H. W. Bergervoet, Daniel E Pagendam, Marjanne de Weerdt, Andrew D. W. Geering, André Drenth, René A. A. van der Vlugt, *Journal of Virological Methods 2014*, 198, 86-94. An outbreak of Potato spindle tuber viroid in tomato linked to imported seed. SL van Brunschot, JTJ Verhoeven, DM Persley, ADW Geering, A Drenth, *European Journal of Plant Pathology 2014*, 1-7.	Prof. André Drenth
	Lucid guide for the identification of rust fungi in Australia published online: http://collections.daff.qld.gov.au/web/key/rustfungi/Media/Html/browse.html Published paper in *Plos ONE* on luminex bead assays for the discrimination of pospiviroid pathogens (see van Brunschot, S. L. et al. (2014) Development of a multiplexed bead-based suspension array for the detection and discrimination of Pospiviroid plant pathogens. *PloS ONE* 9, e84743, doi:10.1371/journal.pone.0084743 (2014). Published paper in *Journal of Virological Methods* on the discrimination of tomato begomoviruses and their whitefly vectors (see 1van Brunschot, S. L. et al. (2014) A bead-based suspension array for the multiplexed detection of begomoviruses and their whitefly vectors. *Journal of Virological Methods* 198, 86-94, doi:http://dx.doi.org/10.1016/j.jviromet.2013.12.014.	Dr Andrew Geering
	Software for streamlined routine analysis of phase two regional variety trial data implemented in Washington University, Apple Breeding Program.	Dr Craig Hardner
	Mody KT, Mahony D, Zhang J, Cavallaro AS, Zhang B, Popat A, Mahony TJ, Yu C, Mitter N (2014) Silica vesicles as nanocarriers and adjuvants for generating both antibody and T-cell mediated immune responses to Bovine Viral Diarrhoea Virus E2 protein. *Biomaterials*, 35(37): 9972-83. Gleeson M, Constantin M, Carroll BJ and Mitter N (2014) MicroRNAs as regulators of adventitious root development. *Journal of Plant Biochemistry and Biotechnology*, 23: 339-347.	Dr Neena Mitter

	Mody KT, Mahony, D, Cavallaro AS, Stahr F, Qiao SZh, Mahony TJ and Mitter N (2014) Freeze-drying of ovalbumin loaded mesoporous silica nanoparticle vaccine formulation increases antigen stability under ambient conditions. *International Journal of Pharmaceutics*, 465 1-2: 325-332. Mahony D, Cavallaro AS, Mody KT, Xiong L, Mahony TJ, Qiao SZ and Mitter N (2014) In vivo delivery of bovine viral diahorrea virus, E2 protein using hollow mesoporous silica nanoparticles. *Nanoscale*, 6 12: 6617-6626. Robinson KE, Worrall, EA and Mitter N (2014) Double stranded RNA expression and its topical application for non-transgenic resistance to plant viruses. *Journal of Plant Biochemistry and Biotechnology,* 23: 231-237. Zhao L, Seth A, Wibowo N, Zhao CX, Mitter N, Yu, C and Middelberg, APJ. (2014) Nanoparticle vaccines. *Vaccine*, 32 3: 327-337. Encina CL, Parisi, A, O'Brien C and Mitter N (2014) Enhancing somatic embryogenesis in avocado (Persea americana Mill.) using a two-step culture system and including glutamine in the culture medium. *Scientia Horticulturae*, 165 44-50. Khalid N, Mitter N, Harper A, Dhingra A, Pappu HR (2014) Comparative Analysis of virus-specific small RNA profiles of three biologically distinct strains of potato virus Y in infected potato (Solanum tuberosum) cv. Russet Burbank.14) , *Virus Research*, 191:153-60. Yang Y, Karmakar S, Zhang J, Yu M, Mitter N and Yu C (2014) Synthesis of SBA-15 rods with small sizes for enhanced cellular uptake. *Journal of Materials Chemistry* B, 2 30: 4929-4934. New International (PCT) Patent Application – BioClay filed with Neena Mitter, Gordon Xu and Max Lu as inventors. New International (PCT) Patent Application – Nanovaccines, Method of synthesis of silica vesicles and use thereof, Neena Mitter, Michael Yu and Jun Zhang as inventors.	
	Mann K.S., Dietzgen R.G. (2014) Plant rhabdoviruses: new insights and research needs in the interplay of negative-strand RNA viruses with plant and insect hosts. *Archives of Virology* 159: 1889-1900. DOI 10.1007/s00705-014-2029-z Dillon N.L., Innes D.J., Bally E.E.S., Wright C.L., Devitt L.C., Dietzgen R.G. (2014) Expressed sequence tag-simple sequence repeat (EST-SSR) marker resources for diversity analysis of mango (*Mangifera indica* L.) *Diversity* 6:72-87. Pierson J.T., Monteith G.R., Roberts-Thomson S.J., Dietzgen R.G., Gidley M.J., Shaw P.N. (2014) Phytochemical extraction, characterisation and comparative distribution across four mango (*Mangifera indica* L.) fruit varieties. *Food Chemistry* 149: 253-263. Dietzgen R.G., Kuhn J.H., Clawson A.N., Freitas-Astua J., Goodin M.M., Kitajima E.W., Kondo H., Wetzel T., Whitfield A.E. (2014) *Dichorhavirus*: a proposed new genus for *Brevipalpus* mite-	A/Prof. Ralf Dietzgen

	transmitted, nuclear, bacilliform, bipartite, negative-strand RNA plant viruses. *Archives of Virology* 159:607-619.	
	Development of assessment methodology to quantify pricing inequities in terms of rural community remoteness and supermarket retail practice, submitted for publication in *Australian Geographer*. Sing-Peterson, L., Lieske, S., Keys, N., and Underhill, S.J.R (2014) Considering Food Pricing Inequities across Queensland, Australia: An Econometric Spatial Analysis. Submitted – *AG* (10 Oct 2014). Development of rapid-whole consignment field heat evaluation demonstration tool for non-English speaking remote farming communities. Zhou, Y., Taylor, M and Underhill, S.J.R (2014) Dwarfing of breadfruit (*Artocarpus altilis*) trees: Opportunities and challenges. *AJEA* (12): 1743-1763. Research to improve postharvest storage of pineapple through better understanding of cell membrane function. Zhou, Y., Pan, X., Qu, H. and Underhill. S.J.R (2014) Low temperature alters plasma membrane lipid composition and ATPase activity of pineapple fruit during blackheart development. *Journal of Bioenergetics and Biomembranes*, 46 (1): 59-69. Zhou, Y., Pan, X., Qu., H., and Underhill, S.J.R. (2014) Tonoplast lipid composition and proton pump of pineapple fruit during low temperature storage and blackheart development. *Journal of Membrane Biology* (in press – accepted 6/3/2014 DOI 10.1007/s00232-014-9650-3).	Dr Steven Underhill
	Created three new experimental zeaxanthin-biofortified sweet-corn hybrids.	Dr Tim O'Hare
	Sultanbawa,Y. (2014). 'Plant extracts as natural antimicrobials in food preservation' in V Ravishankar Rai & Jamuna A. Bai (ed) in *Microbial Food Safety and Preservation Techniques* (pp. 373-382) CRC Press, Taylor & Francis Group, Florida, USA, ISBN 9781466593060. Sultanbawa, Y. (2014). 'Leptospermum (Manuka) Honey: Accepted Natural Medicine' in Laid Boukraa (Ed), *Honey in Traditional and Modern Medicine* (pp.113-124) CRC Press, Taylor & Francis Group, Florida, USA, ISBN 9781439840160. Williams, D. J., Edwards, D., Pun, S., Chaliha, M. and Sultanbawa, Y. Profiling ellagic acid content: The importance of form and ascorbic acid levels. *Food Research International*, 2014, 66:100-106.	Dr Yasmina Sultanbawa
BROAD-ACRE CROP SCIENCE	Christopher JT, Veyradier M, Borrell AK, Harvey G, Fletcher S and Chenu K. 2014. Phenotyping novel stay-green traits to capture genetic variation in senescence dynamics. *Functional Plant Biology* 41:1035-48. (Development of a novel phenotyping strategy for stay-green in cereals). Patents for "Drought Tolerant Plants" that have entered National Entry Phase in 2014:	Dr Andrew Borrell

	Indonesian Patent Application No. W-00201302035 "Drought tolerant plants", Texas A & M University System and The State of Queensland as Represented by the Department of Agriculture, Fisheries and Forestry and Grains Research and Development Corporation, 3 Dec 2014 – Inventor (Borrell et al.). Indian Patent Application No. 1918/KOLNP/2013 "Drought tolerant plants", Texas A & M University System and The State of Queensland as Represented by the Department of Agriculture, Fisheries and Forestry and Grains Research and Development Corporation, 27 Nov 2014 – Inventor (Borrell et al.). Brazilian Patent Application No. BR112013012025.8 "Drought tolerant plants", Texas A & M University System and The State of Queensland as Represented by the Department of Agriculture, Fisheries and Forestry and Grains Research and Development Corporation, 27 Nov 2014 – Inventor (Borrell et al.). European Patent Application No. 11841328.5 "Drought tolerant plants", Texas A & M University System and The State of Queensland as Represented by the Department of Agriculture, Fisheries and Forestry and Grains Research and Development Corporation, 27 Nov 2014 – Inventor (Borrell et al.). United States Patent Application No. 14/358,725 "Drought tolerant plants produced by modification of the staygreen stgx locus", The State of Queensland acting through the Department of Agriculture, Fisheries and Forestry and Texas A & M University System and Grains Research and Development Corporation, 14 Nov 2014 – Inventor (Borrell et al.). Australian Patent Application No. 2013202038 "Drought tolerant plants", The State of Queensland acting through the Department of Agriculture, Fisheries and Forestry and The Texas A & M University System and Grains Research and Development Corporation, 5 Nov 2014 – Inventor (Borrell et al.). Canadian Patent Application No. 2855995 "Drought tolerant plants produced by modification of the staygreen stgx locus", The State of Queensland acting through the Department of Agriculture, Fisheries and Forestry and Texas A & M University System and Grains Research and Development Corporation, 27 Oct 2014 – Inventor (Borrell et al.). Ukrainian Patent Application No. 201307591 "Drought tolerant plants", Texas A & M University System and The State of Queensland as Represented by the Department of Agriculture, Fisheries and Forestry and Grains Research and Development Corporation, 25 Sep 2014 – Inventor (Borrell et al.). Hong Kong Patent Application No. 14105233.0 "Drought tolerant plants", Texas A & M University System and The State of Queensland as Represented by the Department of Agriculture, Fisheries and Forestry and Grains Research and Development Corporation, 19 Sep 2014 – Inventor (Borrell et al.). Mexican Patent Application No. MX/a/2014/005995 "Drought tolerant plants produced by modification of the stay-green stgx	

	locus", The State of Queensland acting through the Department of Agriculture, Fisheries and Forestry and Texas A & M University System and Grains Research and Development Corporation, 16 July 2014 – Inventor (Borrell et al.). Chinese Patent Application No. 201280065782.6 "Drought tolerant plants produced by modification of the staygreen stgx locus", The State of Queensland acting through the Department of Agriculture, Fisheries and Forestry and Texas A & M University System and Grains Research and Development Corporation, Chinese National Phase, 2 July 2014 – Inventor (Borrell et al.). South African Patent Application derived from PCT/AU2012/001423 "Drought tolerant plants produced by modification of the staygreen stgx locus", The State of Queensland acting through the Department of Agriculture, Fisheries and Forestry and Texas A & M University System and Grains Research and Development Corporation, South African National Phase, 15 May 2014 – Inventor (Borrell et al.).	
	Potgieter, A., Power, B., Mclean, J., Davis, p. & Rodriguez, D. 2014. Spatial estimation of wheat yields from Landsat's visible, near infrared and thermal reflectance bands. *International Journal of Remote Sensing Application*, 4, 134-143. Dimes, Rodriguez and Potgieter (2014) raising productivity of maize based cropping systems in eastern and southern Africa – a step-wise intensification approach. In: *Crop Physiology Applications for Genetic Improvement and Agronomy*, Sadras & Calderini eds, second edition. Newlands, N. K., Zamar, David S., Kouadio, Louis A., Zhang, Yinsuo., Chipanshi, Aston., Potgieter, Andries., Toure, Souleymane., Hill, Harvey S. (2014). "An integrated, probabilistic model for improved seasonal forecasting of agricultural crop yield under environmental uncertainty." *Frontiers Environmental Science* 2(17). AB Potgieter, D Rodriguez, B Power, J Mclean, P Davis (2014) Seeing is believing I: The use of thermal sensing from satellite imagery to predict crop yield, IOP conference series: *Earth and Environmental Science* 18 (1), 012118.	Dr Andries Potgieter
	Rodriguez et al., 2014 A participatory whole farm modelling approach to understand impacts and increase preparedness to climate change in Australia Agricultural systems 126, 50-61. Dogliotti S et al, VO 2014 Designing sustainable agricultural production systems for a changing world: Methods and applications. *Agricultural Systems* 126, 1-2.	Dr Daniel Rodriguez
	An update of developments in the APSIM software platform – Holzworth et al (2014) APSIM – Evolution towards a new generation of agricultural systems simulation. *Environmental Modelling and Simulation*. 62: 327–350. Published paper in *Science* on model-based analysis of climate effects on crop yield trends (see Lobell et al (2014) Greater	Prof. Graeme Hammer

	sensitivity to drought accompanies maize yield increase in the US Midwest. Science 344:516-519). Modelling methodology to evaluate crop improvement strategies for sorghum in Australia – Hammer et al (2014) Crop design for specific adaptation in variable dryland production environments. *Crop and Pasture Science* 65: 614–626. Discovery of genetic variation for high temperature shock effects on sorghum seed set – Singh et al. (2015). Sorghum genotypes differ in high temperature responses for seed set. *Field Crops Research* 171: 32-40. Improved technology for genetic control of tillering in sorghum – Alam et al (2014). QTL analysis in multiple sorghum populations facilitates the dissection of the genetic and physiological control of tillering. *Theoretical and Applied Genetics* 127: 2253-2266.	
	A new method for assessing crop adaptation to water-limitation published in the article: Christopher JT, Veyradier M, Borrell AK, Harvey G, Fletcher S and Chenu K (2014) Phenotyping novel stay-green traits to capture genetic variation in senescence dynamics. *Functional Plant Biology* 41:1035-1048. A new method for measuring plant root systems published via the invited conference presentation: Richard C, Hickey L, Chenu K and Christopher K (2014) 'High-throughput phenotyping for seminal root angle in a wheat breeding context', Australasian Plant Breeding Conference, Melbourne 6-9 Oct.	Dr Jack Christopher
	Published paper on improved phenotyping method for staygreen in cereals. See 'Phenotyping novel stay-green traits to capture genetic variation in senescence dynamics', *Functional Plant Biology* 41:1035-1048.	Dr Karine Chenu
	Y.P. Dang, P.W. Moody, M.J. Bell, N.P. Seymour, R.C. Dalal, D.M. Freebairn and S.R. Walker (2014). Strategic tillage in conservation farming systems: II. Implications for productivity, profitability, soil health and environment. *Soil and Tillage Research* (accepted). Y.P. Dang, N.P. Seymour, S.R. Walker, M.J. Bell and D.M. Freebairn (2014). Strategic tillage in conservation farming systems: I. Perceptions, drivers and implementation. *Soil and Tillage Research* (accepted). Massimiliano De Antoni Migliorati, Clemens Scheer, Peter R. Grace, David W. Rowlings, Michael J Bell and James McGree (2014). Influence of different nitrogen rates and DMPP nitrification inhibitor on annual N2O emissions from a subtropical wheat-maize cropping system. *Agriculture, Ecosystems and Environment* 186, 33-43 Bell MJ, Garside AL (2014). Growth and yield responses to amendments to the sugarcane monoculture: Interactions between break history and nitrogen fertiliser. *Crop & Pasture Science* 65, 287-299.014 Massimiliano De Antoni Migliorati, Michael J Bell, Peter R. Grace, David W. Rowlings, Clemens Scheer and Alice Strazzabosco (2014).Assessing environmental and agronomic implications of	Dr Mike Bell

	different N fertilization startegies in subtropical grain cropping systems on Oxisols. *Nutrient Cycling in Agroecosystems* 100, 369-382. McLaren, T.I., Smernik, R.J., Guppy, C.N., Bell, M.J., Tighe, M.K. (2014) The organic P composition of Vertisols as determined by 31P NMR spectroscopy, *Soil Science Society of America Journal* 78(6):1893-1902.	
	Brozynska M, Furtado A and Henry RJ (2014) Direct Chloroplast Sequencing: Comparison of Sequencing Platforms and Analysis Tools for Whole Chloroplast Barcoding, *PloS One* 9 e110387. Healey A, Furtado A, Cooper T, Henry RJ (2014) Protocol: A Simple Method for Extracting Next-Generation Sequencing Quality Genomic DNA from Recalcitrant Plant Species. *Plant Methods* 10, 21. Henry RJ and Nevo E (2014) Exploring natural selection to guide breeding for agriculture. *Plant Biotechnology Journal* 12, 655-662.	Prof. Robert Henry
	Vijaya Gopal Kakani, Timothy R. Wheeler, Peter Q. Craufurd and Rao C. N. Rachaputi 2015. Effect of High Temperature and Water Stress on Groundnuts Under Field Conditions. Ed. R. Mahalingam *Combined Stresses in Plants*. Springer International Publishing Switzerland, DOI 10.1007/978-3-319-07899-1_8. P 1-22. Cheng-Yuan Xu, Shahla Hosseini Bai, Yanbin Hao, Rao C.N. Rachaputi, Zhihong Xu, Helen Wallace 2015. Effect of biochar soil amendment on yield and photosynthesis of peanut on two types of soils in south-east Queensland. *Environmental Science and Pollution Research* (in press). Yashvir S Chauhan, and Rao C N Rachaputi 2014. Defining agro-ecological regions for field crops in variable target production environments: a case study on mungbean in the northern grains region of Australia. *Agricultural and Forest Meteorology* 194: 207-217. Rao C N Rachaputi and Hughes, M., 2014. Productivity and Marketing Enhancement for Peanut in Papua New Guinea and Australia- Adoption study. ACIAR Publication (in press). Rao C N Rachaputi and Wright G.C. 2014. 'Peanuts' in *Encyclopaedia of Food grains* (in press).	Dr Rao (RCN) Rachaputi
FOOD SCIENCE	Gous P, Fox P & Gilbert B. (2015) Drought-proofing barley (*Hordeum vulgare*) and its impact on grain quality: A Review. *J. Institute of Brewing*, DOI 10.1002/jib.187. Fox et al. (2014) Effect of different analysis conditions on Rapid Visco Analyser malt viscograms in relation to malt of varying fermentability *J. Institute of Brewing,* 120: 183-192.	Dr Glen Fox
	Tan, E.T.T.; Fletcher, M.T.; Yong, K.W.L.; D'Arcy, B.R. and Al Jassim, R. Determination of hepatotoxic indospicine in Australian camel meat by ultra-performance liquid chromatography-tandem mass spectrometry. *Journal of Agricultural and Food Chemistry*, 2014, 62, 1974-1979.	Dr Mary Fletcher

	Published paper in *Food Research International* about an improved methodology/approach to assess the nutritional quality of horticultural produce (Queen Garnet plum as an example). Bobrich A, Fanning KJ, Rychlik M, Russell D, Topp B, Netzel M (2014). Phytochemicals in Japanese plums: impact of maturity and bioaccessibility. *Food Research International*, 65, 20-26.	Dr Michael Netzel
	Characterisation of soluble and insoluble cell wall fractions from rye, wheat and hull-less barley endosperm flours, Comino et al, *Food Hydrocolloids* 41 (2014) 219-226. Analytical Methods: Phytochemical extraction, characterisation and comparative distribution across four mango (*Mangifera indica L*.) fruit varieties, Pierson et al, *Food Chemistry* 149 (2014) 253–263. Influence of extrusion on expansion, functional and digestibility, properties of whole sweet potato flour, Waramboi et al, LWT - Food *Science and Technology* 59 (2014) 1136-1145. Freeze-drying changes the structure and digestibility of … starches, Zhang et al, J. Agric. *Food Chemistry*, 2014, 62, 1482−1491.	Prof. Mike Gidley

Appendix A

SURVEY OF FUNDING ORGANISATIONS

With an encouraging 30% increase in the number of respondents over last year, representatives from 15 agriculture and food funding agencies completed an online survey for QAAFI in early 2015. The representatives were from a range of key stakeholders including:

- Australian Centre for International Agricultural Research
- Australian Banana Growers' Association
- Bill & Melinda Gates Foundation
- CRC for High Integrity Australian Pork
- Qld Department of Agriculture & Fisheries
- Grains Research and Development Corporation
- Horticulture Innovation Australia
- Meat and Livestock Australia
- Pork CRC
- Poultry CRC
- Rural Industries Research and Development Corporation
- Sugar Research Australia
- The University of Queensland

The respondents were from senior-management level (and above), including 2 x CEOs, 1 x general manager, 1 x executive manager research, 1 x project manager, 3 x senior research program managers, 3 x R&D managers, 1 x executive director and 1 x head of school at UQ.

Respondents were asked:

1. How would you characterise the quality of QAAFI's scientific output?
2. How does QAAFI's scientific expertise compare with other Australian research organisations?
3. How satisfied are you with the level of engagement offered by QAAFI scientists?
4. Which phrase best describes QAAFI's ability to meet research project outcomes?

Executive summary

When respondents were asked to characterise the institute's scientific output over the past 12 months, all acknowledged QAAFI had met or exceeded their expectations. Of the total, eight acknowledged QAAFI had 'met their expectations', while seven indicated QAAFI's scientific output had been 'above' or 'well above' expectation.

The task of comparing scientific expertise across Australia elicited more nuanced (and fewer) responses. While this is not surprising given QAAFI's breadth of research, one respondent suggested QAAFI's scientific output varied from 'excellent' to something less so. Another suggested QAAFI's close collaboration with the Queensland Government had made it difficult to distinguish scientific accomplishment on projects involving the two organisations. The most positive response was the observation that, across the plant, animal, and food spectrum, 'QAAFI have [sic] delivered an excellent balance of discovery science through to pragmatic solutions for the problems of a range of agricultural/food science industries.'

In terms of scientific engagement, QAAFI scored highly across the survey. With 12 respondents 'very satisfied' and two 'exceedingly satisfied', the majority of stakeholders were clearly supportive of QAAFI's levels of engagement. While one respondent suggested the horticulture industry could be explored for more opportunities, another remarked that 'there are some absolutely excellent, dedicated scientists working for QAAFI who manage to ensure their work is of a high international standard but who are also aware of the practical requirements of industry'.

In the final survey question regarding QAAFI's ability to meet research project outcomes, four respondents described the institute as having 'exceeded expectations', while 10 respondents indicated QAAFI had met their research expectations, and one respondent did not know. One respondent noted: 'I have great confidence in the ability of the scientists to meet the objective of the grant and inspire the national researchers for greater achievement'.

Appendix B

QAAFI RESEARCH HIGHER DEGREE STUDENTS

QAAFI	Number of research higher degree (RHD) students	100
QAAFI	Number of RHD completions (2014)	17

PhD Completions – 2014

Last Name	First Name	Program	Project Title	QAAFI Advisor Name
Bangbol	Harriet	PhD	Genetic characterization of flowering time in sorghum	Dr Erik Van Oosterom Prof. David Jordan
Comino	Penelope	PhD	The Effects of Food Processing on the Solubility and Functionality of Dietary Fibre: Arabinoxylans and b-glucans.	Prof. Mike Gidley Dr Barbara Anne Williams Dr Kinnari Shelat
Finn	Damien	PhD	Methanotrophs from natural ecosystems as biocontrol agents for ruminant methane emissions.	Dr Athol Klieve
Foster	Simon	PhD	Odorant and taste receptor systems in the heart: investigation of novel cardiac biology.	Dr Eugeni Roura
Gestier	Sarah	MPhil	Methodology for the measurement of HIF-1 alpha in bovine leukocytes and assessment of the molecule as a biomarker for bovine respiratory disease outcome.	Dr Tamsin Sarah Barnes
Hall	Robyn	PhD	Investigating Genetic Components of Meleagrid herpesvirus 1 for Viral Vector Applications for the Poultry Industry.	A/Prof. Timothy John Mahony
Harteveld	Dalphy Ondine Camira	PhD	Etiology and diversity of Alternaria leaf blotch and fruit spot of apples in Australia.	Prof. Andre Drenth Dr Olufemi Akinsanmi
Herrington	Mark	PhD	Multi-trait selection of strawberries in southeast Queensland.	Dr Craig Hardner

Hoang	Van	PhD	Nutritional properties of mango fruits: assessing links between genes and bioactivities.	Prof. Mike Gidley A/Prof. Ralf Dietzgen
Laham	Jamaliah	PhD	Supply chain collaboration in the Malaysian pineapple chains.	A/Prof. Steven Underhill
Nguyen	Chuc	PhD	The physiology and genetic of high temperature effects on growth and development of sorghum.	Dr Erik Jan Van Oosterom Prof. Graeme Hammer
Sar	Seila	PhD	Public Health Implications of Rice Starch Structure-Property Relations.	Prof. Robert Gilbert
Smith	Matthew	PhD	The phenotypic and genotypic antimicrobial resistance of enterotoxigenic Escherichia coli and commensal Escherichia coli obtained from healthy and diseased swine in Australia, Canada and Vietnam.	Prof. David Jordan
Sullivan	Mitchell	PhD	Liver-glycogen metabolism: A structural perspective.	Prof. Robert Gilbert Dr Eugeni Roura
Sweedman	Michael	PhD	Octenylsuccinylated starches: Structure and function.	Prof. Robert Gilbert Dr Morgan Jean Tizzotti
Vo	Jenny	PhD	Development and characterisation of novel immunodiagnostic reagents for the detection of banana viruses.	Dr Andrew David William Geering
Witt	Torsten	PhD	The effect of the amylopectin molecular structures on the helical, crystalline and crystalline-amorphous lamellar properties of native starch.	Prof. Robert Gilbert Prof. Mike Gidley

Principally advised PhD students

UQ School of Agriculture & Food Sciences

Last Name	First Name	Project Title	Role	QAAFI Advisor
Chu	Shang	Fitness-for-use starches in cereal grains.	Principal	Prof. Bob Gilbert
Karimaei	Sadegh	Understanding macadamia growth and development through field studies and functional-structural modelling.	Principal	A/Prof. James Hanan

Queensland Alliance for Agriculture & Food Innovation

Last Name	First Name	Project Title	Role	QAAFI Advisor
Ai	Jing	Techniques for delivery of high-moisture lower energy density shelf-stable rice snacks.	Principal	Prof. Mike Gidley
Al-Asmari	Fahad	Assessment of natural antimicrobials and photosensitization on the microbial contamination of dates (*Phoenix doctylifera* L.)	Principal	Dr Yasmina Sultanbawa
Alderees	Fahad	Elucidating mechanisms of antimicrobial activity of Australian native plant extracts.	Principal	Dr Yasmina Sultanbawa
Bhattarai	Rewati	Effect of food structure on enzymatic digestion of starches.	Principal	Prof. Mike Gidley
Brozynska	Marta	Genomic characterisation of Australian wild rice species.	Principal	Prof. Robert Henry
Calvo Brenes	Paula Georgina	"Horticulture postharvest stress memory".	Principal	Dr Timothy O'Hare
Chaliha	Mridusmita	A metabolomic approach to assess the efficacy of Australian native plant extracts in intervening spoilage in a model feed system.	Principal	Dr Yasmina Sultanbawa
Cheng	Bing	Genetic and environmental factors influencing coffee quality.	Principal	Prof. Robert Henry
Chen	Si-Qian	Comparison of the structure and mechanical properties of bacterial cellulose produced by different *Gluconacetobacter xylinus* strains.	Principal	Prof. Mike Gidley
Cho	Sungbo	Nutrient specific appetite in feather pecking hens	Principal	Dr Eugeni Roura
Dinglasan	Eric	Understanding the genetic control of quantitative resistance to yellow spot (*Pyrenophora tritici-repentis*) in wheat (*Triticum aestivum* L.).	Principal	Dr Lee Hickey

Last Name	First Name	Project Title	Role	QAAFI Advisor
Do	Trung Kien	Investigation of disease resistance mechanisms in mango and related species.	Principal	Dr Elizabeth Dann
Doungsa-ard	Chanintorn	Taxonomy and co-evaluation of rust fungi (*Uromycladium* and *Racospermyces*) on Acacia spp. in Australia based on morphological, molecular and biological studies.	Principal	Dr Andrew Geering
Ejigu	Mesfin Dejene	Utilisation of crop residues as ruminant feeds and/or for conservation forming in crop – livestock farming systems.	Principal	Dr Robert Dixon
Falade	Titilayo Diana Omozejele	Aflatoxin detection using Near-infrared Spectroscopy and High Performance Liquid Chromatography – correlations and implications in reduction of aflatoxin contamination through sorting.	Principal	Dr Glen Fox
Fei	Shulang	Identification of candidate genes for blackleg resistance in canola (*Brassica napus*).	Principal	A/Prof. Neena Mitter
Feng	Guangli	Bacteria mediated metabolism of polysaccharides and associated micronutrients in plant cell walls under in vitro and in vivo large intestine conditions.	Principal	Prof. Mike Gidley
Ferguson	Andrew	Immunogenetic Differences Underlying Susceptibility of Cattle to Respiratory Disease.	Principal	A/Prof. Timothy Mahony
Fowler	Ryan	Pathogenicity of Net Form of Net Blotch (*Pyrenophora teres f. teres*).	Principal	Dr Lee Hickey
Fu	Minghai	Manipulation of the preference of piglets for herbal compounds through maternal flavour conditioning to decrease the use of feed antibiotics.	Principal	Dr Eugeni Roura
Gartaula	Ghanendra	Relationship between cereal dietary fibre solubility and phenolic compounds: Methods of increasing the amount of soluble dietary fiber in cereal flours to improve bioactive function.	Principal	Prof. Mike Gidley
Gleeson	Madeleine	Regulation of adventitious rooting in avocado for improved clonal propagation technologies.	Principal	A/Prof. Neena Mitter
Gorham	John	Microbial interaction with plant cell walls.	Principal	Dr Deirdre Mikkelsen
Grant	Lucas	Elucidating the relationship between the physico-chemical structures of dietary fibres and the molecular Profiling and function of gut microbial communities.	Principal	Dr Barbara Williams

Last Name	First Name	Project Title	Role	QAAFI Advisor
Han	Mingxia	Carotenoid bioavailability related to molecular organisation.	Principal	Prof. Mike Gidley
Han	Pengfei	The Australian pork meat flavour: the flavour wheel, retronasal release and satiety.	Principal	Dr Eugeni Roura
Hassen	Solomon	Rules and incentives: managing risks and opportunities in maize-legume dominant farming systems of central and southern Ethiopia.	Principal	A/Prof. Daniel Rodriguez
Healey	Adam	Analysis of variation in genes for biofuel traits in the Eucalypt genome.	Principal	Prof. Robert Henry
Hoang	Nam Van	Analysis of genes controlling the biomass traits in the sugarcane genome.	Principal	Prof. Robert Henry
Hunt	Colleen	Statistical analysis of sorghum breeding trials with complex genetic components.	Principal	Prof. David Jordan
Iqbal	Amjad	Dietary manipulation of nutrient-specific appetite in broiler chickens.	Principal	Dr Eugeni Roura
Khairul Ikram	Emmy Hainida	Evaluation of potential health benefits of different Papaya Cultivars selected *in vitro* assays.	Principal	Dr Michael Netzel
Khemmuk	Wanporn	The co-evolution of wild rice and its pathogens.	Principal	Dr Andrew Geering
Li	Cheng	Development of plants with starch structures for improved digestion characteristics.	Principal	Prof. Robert Gilbert
Li	Hongyan	Rice proteins: value adding through new science.	Principal	Prof. Robert Gilbert
Liu	Dongjie	Effect of plant tissue drying on nutrient release.	Principal	Prof. Mike Gidley
Mann	Krinpreet	Molecular characterisation of the nucleoprotein, phosphoprotein and 4B viral proteins of Lettuce necrotic yellows virus in both plant host and insect vectors.	Principal	A/Prof. Ralf Dietzgen
Meldrum	Oliver	Defining the disassembly of plant cell walls and component polysaccharides within the digestive tract, their influence on the resident microflora and the host immune system.	Principal	Prof. Mike Gidley
Mindaye	Taye Tadesse	Genotypic variability and combining ability study of sorghum [Sorghum bicolor (L) Moench] inbred lines and multi environment evaluation of their derived hybrids.	Principal	Prof. David Jordan

Last Name	First Name	Project Title	Role	QAAFI Advisor
Mizani	Anahita	Towards high density production systems for mango: architectural analysis of vigour management techniques.	Principal	A/Prof. James Hanan
Mody	Karishma	Nanoparticle based delivery of veterinary vaccine for improved shelf life and elimination of cold chain storage using Bovine viral diarrhoea virus surface glycoprotein E2 and Ovalbumin as model systems.	Principal	A/Prof. Neena Mitter
Moosavi	Seyed	Applying genomics to macadamia improvement.	Principal	Prof. Robert Henry
Navarro Gomez	Marta	Improving quality and safety of poultry meat with synergistic combinations of bioactive plant extracts.	Principal	Dr Yasmina Sultanbawa
Neilsen	Merran	Mechanisms of cultivar-and race-based disease resistance in avocado.	Principal	Prof. Andre Drenth
Nguyen	Tuyet Giang	Dependence of digestion and growth rate of pigs on taro (*Colocasia esculenta)* foliage.	Principal	Dr Peter Sopade
Nhantumbo	Nascimento Salomao	The effects of residue management strategies on nitrogen and water use efficiency in Maize-Legume cropping systems.	Principal	A/Prof. Daniel Rodriguez
Nirmal	Ravi Chandrabhan	Genomics of wheat quality for bread production.	Principal	Prof. Robert Henry
O'Connor	Daniel	Integration of rapid phenotyping and genotyping tools for peanut genetic improvement.	Principal	Dr Nageswararao Chenchu Rachaputi
O'Donoghue	Adam	The role of lycopene and ketosamines in tomatoes as a protective agent against prostate cancer.	Principal	Dr Timothy O'Hare
Palou Egoaguirre	Rousset Leslie	Use of plant derived compounds to condition piglet intake at weaning and reduce post-weaning use of therapeutics.	Principal	Dr Eugeni Roura
Pappu	Usha	Understanding Coffee Quality: Determining consumer value for premium coffee.	Principal	Dr Heather Smyth
Parkinson	Louisamarie	Investigating avocado tree mortality during early field establishment.	Principal	Dr Elizabeth Dann
Poppi	David	Elucidation of the roles and requirements of sulphur amino acids in the diet of barramundi.	Principal	Prof. Stephen Moore
Powell	Jonathan	Identifying sources of resistance to Fusarium diseases using the model plant *Brachypodium distachyon*.	Principal	Prof. Robert Henry

Last Name	First Name	Project Title	Role	QAAFI Advisor
Powell	Prudence	A Plant Model for Diabetes.	Principal	Prof. Robert Gilbert
Reyes Ponce	Andres	The physiological basis of genetic improvement in maize yield in the US Corn Belt.	Principal	Prof. Graeme Hammer
Riaz	Adnan	Harnessing novel sources of adult plant resistance to leaf rust in wheat.	Principal	Dr Lee Hickey
Richard	Cecile	Delivery of wheat root traits that contribute to water limited yield stability.	Principal	Dr Jack Christopher
Robinson	Hannah	Investigating the relationship between stress tolerance genes and grain quality in barley (*Hordeum vulgare* L.).	Principal	Dr Glen Fox
Roxburgh	Caspar	Nutrient management under conservation agriculture systems in semi-arid areas of Queensland and Southern/Eastern Africa.	Principal	A/Prof. Daniel Rodriguez
Seyoum	Solomon Admassu	Characterization of production environments and genotypes to improve selection for drought and heat adaptation of maize in Sub-Saharan Africa and Australia.	Principal	Dr Nageswararao Chenchu Rachaputi
Sharman	Murray	Diversity and epidemiology of Tobacco streak virus in Australia.	Principal	Dr John Thomas
Smith	John	The impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton in southern QLD.	Principal	A/Prof. Mike Bell
Sunarharum	Wenny-Bekti	The compositional basis of coffee flavour.	Principal	Dr Heather Smyth
Sun	Lijun	Studying the effect of phytochemicals on starch digestion in vitro and in vivo.	Principal	Prof. Mike Gidley
Survase	Abhijeet	Genomic strategies for reducing losses during processing and improving the nutritional value of wheat in human diet.	Principal	Prof. Robert Henry
Tan	Eddie Ti Tjih	Food Safety Assessment of Indospicine.	Principal	Dr Mary Fletcher
Tefera	Abeya Temesgen	Understanding the opportunities from conservation agriculture in sub-humid maize-legume farming systems of Ethiopia.	Principal	A/Prof. Daniel Rodriguez
Temba	Benigni Alfred	Tracking factors influencing Aflatoxin contamination profile along the maize value chain in Tanzania.	Principal	Dr Mary Fletcher
Thavaraj	Pridhuvi	Investigating the effect of casein micelle size on the physico-chemical and functional properties of milk gels.	Principal	Dr Eugeni Roura

Last Name	First Name	Project Title	Role	QAAFI Advisor
Tikapunya	Tiparat	Grain quality of Australian wild rice compared to domesticated rice.	Principal	Prof. Robert Henry
Toft	Benjamin David	Understanding macadamia architectural development and responses to manipulation to improve productivity and profitability.	Principal	A/Prof James Hanan
Tran	Nga	Identity, population biology and development of molecular diagnostic tools for early detection and control of the citrus scab fungus *Elsinoe* spp.	Principal	A/Prof Ralf Dietzgen
Tran	Thi Minh Hue	Genetic analysis of coffee quality.	Principal	Prof. Robert James Henry
Wambugu	Peterson Weru	Analysing Molecular Genetic Diversity of Cultivated and Wild Rice Species.	Principal	Prof. Robert Henry
Widana Gamage	Shirani	Thrips-tospovirus interactions.	Principal	A/Prof. Ralf Dietzgen
Worrall	Elizabeth	Crop protection through topical application of clay based nanoparticles to deliver RNAi.	Principal	A/Prof Neena Mitter
Yu	Wen Wen	Towards new means of prevention and health maintenance for diabetes: new characterisation techniques for starch and glycogen.	Principal	Prof. Robert Gilbert
Zhai	Honglei	In vivo and in vitro studies of cereal grain effects on lipid metabolism.	Principal	Prof. Mike Gidley
Ziems	Laura	Dissecting the genetic interactions associated with Rph20 resistance to leaf rust (*Puccinia hordei*) in barley.	Principal	Dr Lee Thomas Hickey
Zou	Wei	Starches with improved nutritional and material properties.	Principal	Prof. Robert Gilbert

Appendix C

QAAFI SCIENTIFIC PUBLICATIONS

BOOKS

Cereal Genomics Methods and Protocols Preface. Edited by Robert J. Henry and Agnelo Furtado New York, NY United States: Humana Press, 2014. doi: 10.1007/978-1-62703-715-0.

BOOK CHAPTERS

1. Gopala Krishnan, S., Waters, D. & Henry, R. (2014) A method for discovery of genome-wide SNP between any two genotypes from whole-genome re-sequencing data. In Robert J. Henry, Agnelo Furtado (Eds.), Cereal Genomics: Methods and Protocols (pp. 287-294). New York, United States: Humana Press.
2. Gopala Krishnan, S., Waters, Daniel L. E. and Henry, Robert J. (2014). A method for discovery of genome-wide SNP between any two genotypes from whole-genome re-sequencing data. In Robert J. Henry and Agnelo Furtado (Ed.), Cereal Genomics: Methods and Protocols (pp. 287-294) New York, United States: Humana Press. doi:10.1007/978-1-62703-715-0_24.
3. Henry, Robert J., Rice, Nicole, Edwards, Mark and Nock, Catherine J. (2014). Next-generation technologies to determine plastid genome sequences. In Pal Maliga (Ed.), Chloroplast Biotechnology: Methods and Protocols (pp. 39-46) New York, NY, United States: Humana Press. doi:10.1007/978-1-62703-995-6_2
4. Schenk, P. (2014) Rapid cloning of genes and promoters for functional analyses. In Agnelo Furtado, Robert J. Henry (Eds.), Methods in molecular biology: cereal genomics (pp. 123-132). New York, United States: Humana Press.
5. Henry, R., Rice, N. Edwards, M. & Nock, C. (2014) Next-generation technologies to determine plastid genome sequences. In Pal Maliga (Eds.), Chloroplast Biotechnology: Methods and Protocols (pp. 39-46). New York, NY, United States: Humana Press.
6. Yakubov, G., Gibbins, H. Proctor, G. & Carpenter, G. (2014) Oral mucosa: physiological and physicochemical aspects. In Vitaliy V. Khutoryanskiy (Eds.), Mucoadhesive Materials and Drug Delivery Systems (pp. 3-37). Chichester, West Sussex, UK: John Wiley & Sons.
7. Yakubov, G., Singleton, S. & Williamson, A. (2014) Methods for assessing mucoadhesion: the experience of an integrative approach. In Vitaliy V. Khutoryanskiy (Eds.), Mucoadhesive Materials and Drug Delivery Systems (pp. 197-232). Chichester, West Sussex, UK: John Wiley & Sons.
8. Sultanbawa, Y. (2014) Leptospermum (Manuka) honey: accepted natural medicine. In Laïd Boukraâ (Eds.), Honey in Traditional and Modern Medicine (pp. 113-124). Boca Raton, FL, USA: CRC Press.
9. Reglinski, T., Dann, E. & Deverall, B. (2014) Implementation of induced resistance for crop protection. In Dale R. Walters, Adrian C. Newton, Gary D. Lyon (Eds.), Induced Resistance for Plant Defense: A Sustainable Approach to Crop Protection 2nd ed. (pp. 249-299). Oxford, UK: John Wiley & Sons.

JOURNAL ARTICLES

1. Able, A., Smyth, H. & Joyce, D. (2014) Postharvest physiology and volatile production by flowers of Ptilotus nobilis. Postharvest Biology and Technology, 88: 61-71.
2. Abo-Ismail, M., Vander Voort, G., Squires, J., Swanson, K., Mandell, I., Liao, X. et al. (2014) Single nucleotide polymorphisms for feed efficiency and performance in crossbred beef cattle. BMC Genetics, 15: 14.1-14.14.
3. Abo-Ismail, M.K., Vander Voort, G., Squires, J.J., Swanson, K.C., Mandell, I.B., Liao, X., Stothard, P., Moore, S., Plastow, G., Miller, S.P. (2014) Single nucleotide polymorphisms for feed efficiency and performance in crossbred beef cattle. BMC Genetics 15:14.
4. Akanno, E.C., Plastow, G., Woodward, B.W., Bauck, S., Okut, H., Wu, X.L., Sun, C., Aalhus, J.L., Moore, S.S., Miller, S.P., Wang, Z., Basarab, J.A. (2014) Reliability of molecular breeding values for Warner-Bratzler shear force and carcass traits of beef cattle-An independent validation study. J. Anim. Sci. Published online before print May 6, 2014, doi:10.2527/jas.2013-7374.
5. Aguilar Pierle, S., Rosshandler, I., Akim Kerudin, A., Sambono, J., Lew-Tabor, A., Rolls, P. et al. (2014) Genetic diversity of tick-borne rickettsial pathogens: insights gained from distant strains. Pathogens, 3(1): 57-72.
6. Ahmed, S., Humphreys, E.Salim, M. & Chauhan, B. (2014) Optimizing sowing management for short duration dry seeded aman rice on the High Ganges River floodplain of Bangladesh. Field Crops Research, 169: 77-88.

7. Ahmed, S., Salim, M. & Chauhan, B. (2014) Effect of Weed Management and Seed Rate on Crop Growth under Direct Dry Seeded Rice Systems in Bangladesh. PLoS One, 9(7): e101919.1-e101919.10.
8. Aitken, K., McNeil, M., Hermann, S., Bundock, P., Kilian, A., Heller-Uszynska, K. et al. (2014) A comprehensive genetic map of sugarcane that provides enhanced map coverage and integrates high-throughput Diversity Array Technology (DArT) markers. BMC Genomics, 15(152): 1-12.
9. Aitken, Karen S., McNeil, Meredith D., Hermann, Scott, Bundock, Peter C., Kilian, Andrzej, Heller-Uszynska, Katarzyna, Henry, Robert J. and Li, Jingchuan (2014) A comprehensive genetic map of sugarcane that provides enhanced map coverage and integrates high-throughput Diversity Array Technology (DArT) markers. BMC Genomics, 15 152: 1-12. doi: 10.1186/1471-2164-15-152.
10. Alam, M., Hammer, G., Van Oosterom, E., Cruickshank, A., Hunt, C. & Jordan, D. (2014) A physiological framework to explain genetic and environmental regulation of tillering in sorghum. New Phytologist, 203(1): 155-167.
11. Alam, M., Mace, E., van Oosterom, E., Cruickshank, A., Hunt, C., Hammer G.L. et al. (2014) QTL analysis in multiple sorghum populations facilitates the dissection of the genetic and physiological control of tillering. Theoretical and Applied Genetics, 127(10): 2253-2266.
12. Alam, M.M., Hammer, G.L., van Oosterom, E.J., Cruickshank, A., Hunt, C., and Jordan, D.R. (2014) A physiological framework to explain genetic and environmental regulation of tillering in sorghum. New Phytologist 203: 155-167 doi: 10.1111/nph.12767.
13. Alawneh, J., Barnes, T., Parke, C., Lapuz, E., David, E., Basinang, V. et al. (2014) Description of the pig production systems, biosecurity practices and herd health providers in two provinces with high swine density in the Philippines. Preventive Veterinary Medicine: 1-47.
14. Awan, T., Sta Cruz, P. & Chauhan, B. (2014) Ecological significance of rice (Oryza sativa) planting density and nitrogen rates in managing the growth and competitive ability of itchgrass (Rottboellia cochinchinensis) in direct-seeded rice systems. Journal of Pest Science: 1-12.
15. Azeem, M., Riaz, A., Chaudhary, A., Hayat, R., Hussain, Q., Tahir, M. et al. (2014) Microbial phytase activity and their role in organic P mineralization. Archives of Agronomy and Soil Science: 1-16.
16. Azevedo, C., Silva, F., de Resende M. D. V., Lopes. M. S., Duijvesteijn, N., Guimaraes, S. et al. (2014) Supervised independent component analysis as an alternative method for genomic selection in pigs. Journal of Animal Breeding and Genetics, 131(6): 452-461.
17. Bari, A., Amri, A., Street, K., Mackay, M., De Pauw, E., Sanders, R. et al. (2014) Predicting resistance to stripe (yellow) rust (Puccinia striiformis) in wheat genetic resources using focused identification of germplasm strategy. The Journal of Agricultural Science, 152(6): 906-916.
18. Barrero, R., Moolhuijzen, P., Indjein, L., Venus, B., Keeble-Gagnère, G., Power, J. et al. (2014) Draft genome sequences of Campylobacter fetus subsp. venerealis bv. venerealis strain B6 and bv. intermedius strain 642-21. Genome Announcements, 2(5): e00943-14.1-e00943-14.2.
19. Bell, M. (2014) Growth and yield responses to amending the sugarcane monoculture: interactions between break history and nitrogen fertiliser. Crop and Pasture Science, 65(3): 287-299.
20. Berkman, Paul J., Bundock, Peter C., Casu, Rosanne E., Henry, Robert J., Rae, Anne L. and Aitken, Karen S. (2014) A Survey Sequence Comparison of Saccharum Genotypes Reveals Allelic Diversity Differences. Tropical Plant Biology, 7 2: 71-83. doi:10.1007/s12042-014-9139-3
21. Blackburn, G. (2014) Elements of successful change: the Service Tasmania experience to public sector reform. Australian Journal of Public Administration, 73(1): 103-114.
22. Boddhireddy, P., Kelly, M., Northcutt, S., Prayaga, K., Rumph, J. & DeNise, S. (2014) Genomic predictions in Angus cattle: comparisons of sample size, response variables, and clustering methods for cross-validation. Journal of Animal Science, 92(2): 485-497.
23. Borrell, A., Mullet, J., George-Jaeggli, B., van Oosterom, E., Hammer, G., Klein, P. et al. (2014) Drought adaptation of stay-green cereals is associated with canopy development, leaf anatomy, root growth and water uptake. Journal of Experimental Botany, 65(21): 6261-6263.
24. Borrell, A.K., van Oosterom, E.J., Mullet, J.E., George-Jaeggli, B., Jordan, D.R., Klein, P.E., and Hammer, G.L. (2014) Stay-green alleles individually enhance grain yield in sorghum under drought by modifying canopy development and water uptake patterns. New Phytologist 203:817-830. doi: 10.1111/nph.12869.
25. Brozynska, M., Furtado, A. & Henry, R. (2014) Direct Chloroplast sequencing: Comparison of sequencing platforms and analysis tools for whole chloroplast barcoding. PLoS One, 9(10): e110387-e110387.

26. Brozynska, M., Omar, E., Furtado, A., Crayn, D., Simon, B., Ishikawa, R. et al. (2014) Chloroplast genome of novel rice germplasm identified in Northern Australia. Tropical Plant Biology, 7(3-4): 111-120.
27. Brozynska, Marta, Omar, Ernnie Syafika, Furtado, Agnelo, Crayn, Darren, Simon, Bryan, Ishikawa, Ryuji and Henry, Robert James (2014) Chloroplast genome of novel rice germplasm identified in Northern Australia. Tropical Plant Biology, 7 3-4: 111-120. doi:10.1007/s12042-014-9142-8.
28. Canovas, A., Reverter, A., DeAtley, K., Ashley, R., Colgrave, M., Fortes, M. et al. (2014) Multi-tissue omics analyses reveal molecular regulatory networks for puberty in composite beef cattle. PLoS ONE, 9(7).
29. Chauhan, B., Ngoc, S.Duong, D. & Le Ngoc, P. (2014) Effect of pretilachlor on weedy rice and other weeds in wet-seeded rice cultivation in South Vietnam. Plant Production Science, 17(4): 315-320.
30. Chauhan, K., Seale, R.Deeth, H. & Turner, M. (2014) Hypervariable pili and flagella genes provide suitable new targets for DNA high-resolution melt-based genotyping of dairy Geobacillus spp. Journal of Food Protection, 77(10): 1715-1722.
31. Chauhan, Y. & Rachaputi, R. (2014) Defining agro-ecological regions for field crops in variable target production environments: a case study on mungbean in the northern grains region of Australia. Agricultural and Forest Meteorology, 194: 207-217.
32. Chen, S., Wang, D., Xu, C., Ji, C., Zhang, X., Zhao, X. et al. (2014) Responses of super rice (Oryza sativa L.) to different planting methods for grain yield and nitrogen-use efficiency in the single cropping season. PLoS One, 9(8): e104950.1-e104950.9.
33. Cheong, E., Sandhu, A., Jayabalan, J., Kieu Le, T., Nhiep, N., My Ho, H. et al. (2014) Isolation of lactic acid bacteria with antifungal activity against the common cheese spoilage mould Penicillium commune and their potential as biopreservatives in cheese. Food Control, 46: 91-97.
34. Chenu, Karine, Zheng, Bangyou and Chapman, Scott (2014). Breeding for the future: How to adapt to potential impacts of future frost, drought and heat events on Australian wheat?. In: Breeding Plants to Cope with Future Climate Change, Leeds, United Kingdom, 16-18 June 2014.
35. Choudhary, V., Dixit, A.Kumar, P. & Chauhan, B. (2014) Productivity, weed dynamics, nutrient mining, and monetary advantage of maize-legume intercropping in the Eastern Himalayan region of India. Plant Production Science, 17(4): 342-352.
36. Cleary, E., Barnes, T., Xu, Y., Zhao, H., Clements, A., Gray, D. et al. (2014) Impact of “Grain to Green” programme on echinococcosis infection in Ningxia Hui Autonomous Region of China. Veterinary Parasitology, 205(3-4): 523-531.
37. Denoeud, France, Carretero-Paulet, Lorenzo, Dereeper, Alexis, Droc, Gaetan, Guyot, Romain, Pietrella, Marco, Zheng, Chunfang, Alberti, Adriana, Anthony, Francois, Aprea, Giuseppe, Aury, Jean-Marc, Bento, Pasca;, Bernard, Maria, Bocs, Stephanie, Campa, Claudine, Cenci, Alberto, Combes, Marie-Christine, Crouzillat, Dominique, Da Silva, Corinne, Daddiego, Loretta, De Bellis, Fabien, Dussert, Stephane, Garsmeur, Olivier, Gayraud, Thomas, Guignon, Valentin, Jahn, Katharina, Jamilloux, Veronique, Joet, Thierry, Labadie, Karine, Lan, Tianying, Leclercq, Julie, Lepelley, Maud, Leroy, Thierry, Li, Lei-Ting, Librado, Pablo, Lopez, Loredana, Munoz, Adriana, Noel, Benjamin, Pallavicini, Alberto, Perrotta, Gaetano, Poncet, Valerie, Pot, David, Priyono,, Rigoreau, Michel, Rouard, Mathieu, Rozas, Julio, Tranchant-Dubreuil, Christine, VanBuren, Robert, Zhang, Qiong, Andrade, Alan C., Argout, Xavier, Bertrand, Benoit, De Kochko, Alexandre, Graziosi, Giorgio, Henry, Robert J., Jayarama,, Ming, Ray, Nagai, Chifumi, Rounsley, Steve, Sankoff, David, Giuliano, Giovanni, Albert, Victor A., Wincker, Patrick and Lashermes, Philippe (2014) The coffee genome provides insight into the convergent evolution of caffeine biosynthesis. Science, 6201: 1181-1184. doi:10.1126/science.1255274.
38. Dayao, D., Gibson, J.Blackall, P. & Turni, C. (2014) Antimicrobial resistance in bacteria associated with porcine respiratory disease in Australia. Veterinary Microbiology, 171(1-2): 232-235.
39. Dietzgen, R., Kuhn, J., Clawson, A., Freitas-Astua, J., Goodin, M., Kitajima, E. et al. (2014) Dichorhavirus: a proposed new genus for Brevipalpus mite-transmitted, nuclear, bacilliform, bipartite, negative-strand RNA plant viruses. Archives of Virology, 159(3): 607-619.
40. Dillon, N., Innes, D., Bally, I., Wright, C., Devitt, L. & Dietzgen, R. (2014) Expressed sequence tag-simple sequence repeat (EST-SSR) marker resources for diversity analysis of mango (Mangifera indica L.). Diversity, 6(1): 72-87.
41. Doungsa-ard, C., McTaggart, A., Geering, A., Dalisay, T., Ray, J. & Shivas, R. (2015) Uromycladium falcatarium sp. nov., the cause of gall rust on Paraserianthes falcataria in south-east Asia. Australasian Plant Pathology, 44(1): 25-30.
42. Dreccer, M., Barnes, L. & Meder, R. (2014) Quantitative dynamics of stem water soluble carbohydrates in wheat can be monitored in the field using hyperspectral reflectance. Field Crops Research, 159: 70-80.
43. Dreccer, M., Wockner, K., Palta, J., McIntyre, C., Borgognone, M., Bourgault, M. et al. (2014) More fertile florets and grains per spike can be achieved at higher temperature in wheat lines with high spike biomass and sugar content at booting. Functional Plant Biology, 41(5): 482-495.

44. Duffy, L., Blackall, P.Cobbold, R. & Fegan, N. (2014) Quantitative effects of in-line operations on Campylobacter and Escherichia coli through two Australian broiler processing plants. International Journal of Food Microbiology, 188: 128-134.
45. Dutta, M., Sokhandan Bashir, N.Palmer, M. & Melcher, U. (2014) Genomic characterization of Ambrosia asymptomatic virus 1 and evidence of other Tymovirales members in the Oklahoma tallgrass prairie revealed by sequence analysis. Archives of Virology, 159(7): 1755-1764.
46. Easton, D., Allsopp, L., Phan, M., Gomes Moriel, D., Goh, G., Beatson, S. et al. (2014) The intimin-like protein FdeC is regulated by H-NS and temperature in Enterohaemorrhagic Escherichia coli. Applied and Environmental Microbiology, 80(23): 7337-7347.
47. Eliott, F., Shepherd, M., Rossetto, M., Bundock, P., Rice, N. & Henry, R. (2014) Contrasting breeding systems revealed in the rainforest genus Davidsonia (Cunoniaceae): Can polyembryony turn the tables on rarity? Australian Journal of Botany, 62(6): 451-464.
48. Eliott, F. G., Shepherd, M., Rossetto, M., Bundock, P., Rice, N. and Henry, R. J. (2014) Contrasting breeding systems revealed in the rainforest genus Davidsonia (Cunoniaceae): Can polyembryony turn the tables on rarity?. Australian Journal of Botany, 62 6: 451-464. doi:10.1071/BT14063.
49. Encina, C., Parisi, A.O'Brien, C. & Mitter, N. (2014) Enhancing somatic embryogenesis in avocado (Persea americana Mill.) using a two-step culture system and including glutamine in the culture medium. Scientia Horticulturae, 165: 44-50.
50. Fletcher, M., Chow, S. & Ossedryver, S. (2014) Effect of increasing low dose simplexin exposure in cattle consuming Pimelia trichostachya. Journal of Agricultural and Food Chemistry, 62(30): 7402-7406.
51. Fordyce, G., McGowan, M., Lisle, A., Muller, T., Allen, J., Duff, C. et al. (2014) Scrotal circumference of Australian beef bulls. Theriogenology, 81(6): 805-812.
52. Fortes, M.R.S., Suhaimi, A. H.M.S., Porto-Neto, L.R., McWilliam, S.M., Flatscher-Bader, T., Moore, S.M., D'Occhio, M.J., Meira, C.T., Thomas, M.G., Snelling, W.M., Reverter, A., Lehnert, S.A. (2014) Post-partum anoestrus in tropical beef cattle: A systems approach combining gene expression and genome-wide association results. Livestock Science http://dx.doi.org/10.1016/j.livsci.2014.06.017.
53. Furtado, A., Lupoi, J., Hoang, N., Healey, A., Singh, S., Simmons, B. et al. (2014) Modifying plants for biofuel and biomaterial production. Plant Biotechnology Journal, 12(9): 1246-1258.
54. Furtado, Agnelo, Lupoi, Jason S., Hoang, Nam V., Healey, Adam, Singh, Seema, Simmons, Blake A. and Henry, Robert J. (2014) Modifying plants for biofuel and biomaterial production. Plant Biotechnology Journal, 12 9: 1246-1258. doi:10.1111/pbi.12300
55. García-Sánchez, A., Morales-Erasto, V., Talavera-Rojas, M., Robles-González, F., Allen, M., Blackall, P. et al. (2014) Phylogenetic relationship of serovar C-1 isolates of Avibacterium paragallinarum. Avian Diseases, 58(1): 143-146.
56. Geering, A., Maumus, F., Copetti, D., Choisne, N., Zwickl, D., Zytnicki, M. et al. (2014) Endogenous florendoviruses are major components of plant genomes and hallmarks of virus evolution. Nature Communications, 5: 5269.1-5269.11.
57. Gleeson, M., Constantin, M.Carroll, B. & Mitter, N. (2014) MicroRNAs as regulators of adventitious root development. Journal of Plant Biochemistry and Biotechnology, 23(4): 339-347.
58. Godwin, S., Kang, A., Gulino, L., Manefield, M., Gutierrez-Zamora, M., Kienzle, M. et al. (2014) Investigation of the microbial metabolism of carbon dioxide and hydrogen in the kangaroo foregut by stable isotope probing. ISME Journal, 8(9): 1855-1865.
59. Hammer, G., McLean, G., Chapman, S., Zheng, B., Doherty, A., Harrison, M. et al. (2014) Crop design for specific adaptation in variable dryland production environments. Crop and Pasture Science, 65(7): 614-626.
60. Hardy, M. (2014) Resistance is not futile: it shapes insecticide discovery. Insects, 5(1): 227-242.
61. Harrison, M., Tardieu, F.Dong, Z. Messina, C. & Hammer, G. (2014) Characterizing drought stress and trait influence on maize yield under current and future conditions. Global Change Biology, 20(3): 867-878.
62. Harteveld, D., Akinsanmi, O. & Drenth, A. (2014) Pathogenic variation of Alternaria species associated with leaf blotch and fruit spot of apple in Australia. European Journal of Plant Pathology, 139(4): 789-799.
63. Hay, K., Barnes, T.Morton, J. Clements, A. & Mahony, T. (2014) Risk factors for bovine respiratory disease in Australian feedlot cattle: use of a causal diagram-informed approach to estimate effects of animal mixing and movements before feedlot entry. Preventive Veterinary Medicine, 117(1): 160-169.
64. Healey A., Furtado A., Cooper T. and Henry R.J. (2014) Protocol: A simple method for extracting next-generation sequencing quality genomic DNA from recalcitrant plant species. Plant Methods, 10 1: doi:10.1186/1746-4811-10-21.
65. Henry, R. (2014) Wheat genomics for grain quality improvement. Cereal Foods World, 59(1): 22-24.
66. Henry, R. (2014) Genomics strategies for germplasm characterization and the development of climate resilient crops. Frontiers in Plant Science, 5(FEB): 68.1-68.4.

67. Henry R.J. and Nevo E. (2014) Exploring natural selection to guide breeding for agriculture. Plant Biotechnology Journal, 12 6: 655-662. doi:10.1111/pbi.12215.
68. Holzworth, D., Huth, N., deVoil, P., Zurcher, E., Herrmann, N., McLean, G. et al. (2014) APSIM - evolution towards a new generation of agricultural systems simulation. Environmental Modelling and Software, 62: 327-350.
69. Holzworth DP, Huth NI, deVoil PG, Zurcher EJ, Herrmann NI, McLean G, Chenu K, van Oosterom E, Snow V, Murphy C, Moore AD, Brown HE, Whish JP, Verrall S, Fainges J, Bell L, Peake A, Poulton P, Hochman Z, Thorburn PJ, Gaydon DS, Dalgliesh N, Rodriguez D, Cox H, Chapman S, Doherty A, Teixeira E, Sharp J, Cichota R, Vogeler I, Li F, Wang E, Hammer GL, Robertson MJ, Dimes J, Carberry P, Hargreaves JNG, MacLeod N, McConald C, Harsdorf J, Wedgewood S, Keating BA. (2014) APSIM - Evolution towards a new generation of agricultural systems simulation. Environmental Modelling and Simulation. 62: 327-350.
70. Horwood, P., Schibrowski, M., Fowler, E., Gibson, J., Barnes, T. & Mahony, T. (2014) Is Mycoplasma bovis a missing component of the bovine respiratory disease complex in Australia? Australian Veterinary Journal, 92(6): 185-191.
71. Karisa, B., Moore, S., Plastow, G. (2014) Analysis of biological networks and biological pathways associated with residual feed intake in beef cattle. Animal Sci. J. 85: 374-387.
72. Karisa, B.K, Thomson, J., Wang, Z., Li, C., Montanholi, Y., Miller, S.P., Moore, S.S., Plastow, G.S. (2014) Plasma metabolites associated with residual feed intake and other productivity performance traits in beef cattle. Livestock Science http://dx.doi.org/10.1016/j.livsci.2014.03.002
73. Kasem, S., Waters, D. Ward, R. Rice, N. & Henry, R. (2014) Wild Oryza grain physico-chemical properties. Tropical Plant Biology, 7(1): 13-18.
74. Khaliq, A., Matloob, A. & Chauhan, B. (2014) Weed management in dry-seeded fine rice under varying row spacing in the rice-wheat system of Punjab, Pakistan. Plant Production Science, 17(4): 321-332.
75. Kholová, J., Murugesan, T., Kaliamoorthy, S., Malayee, S., Baddam, R., Hammer, G.L., McLean, G., Deshpande, S., Hash, C.T., Craufurd, P.Q., and Vadez, V. (2014) Modelling the effect of plant water use traits on yield and stay-green expression in sorghum. Functional Plant Biology 41: 1019-1034.
76. Krishna S., G., Waters, D. & Henry, R. (2014) Australian wild rice reveals pre-domestication origin of polymorphism deserts in rice genome. PLoS One, 9(6): e98843.1-e98843.6.
77. Kumudini, S., Andrade, F., Boote, K., Brown, G., Dzotsi, K., Edmeades, G. et al. (2014) Predicting maize phenology: intercomparison of functions for developmental response to temperature. Agronomy Journal, 106(6): 2087-2097.
78. Li, X., Yang, Y., Henry, R., Rossetto, M., Wang, Y. & Chen, S. (2014) Plant DNA barcoding: from gene to genome. Biological Reviews, Early View: 1-10.
79. Liberato, J., McTaggart, A. & Shivas, R. (2014) First report of Masseeëlla capparis in Australia. Australasian Plant Disease Notes, 9(1).
80. Liu, Ya-Xi, Wang, Ji-Rui, Liu, Ze-Hou, Wang, Yan, Chen, Xing, Henry, Robert J., Wei, Yu-Ming, Nevo, Eviatar and Zheng, You-Liang (2014) Adaptive evolution of alpha-amylase genes in wild barley (Hordeum spontaneum) on micro and macro scales. Journal of Systematics and Evolution, 52 6: 765-778. doi:10.1111/jse.12108.
81. Liu, F., Xiong, X., Wu, L., Fu, D., Hayward, A., Zeng, X. et al. (2014) BraLTP1, a lipid transfer protein gene involved in epicuticular wax deposition, cell proliferation and flower development in Brassica napus. PLoS ONE, 9(10): 1-12.
82. Liu, Y., Wang, J., Liu, Z., Wang, Y., Chen, X., Henry, R. et al. (2014) Adaptive evolution of alpha-amylase genes in wild barley (Hordeum spontaneum) on micro and macro scales. Journal of Systematics and Evolution, 52(6): 765-778.
83. Lobell, D., Roberts, M., Schlenker, W., Braun, N., Little, B., Rejesus, R. et al. (2014) Greater sensitivity to drought accompanies maize yield increase in the U.S. Midwest. Science, 344(6183): 516-519.
84. Lupoi, J., Singh, S., Davis, M., Lee, D., Shepherd, M., Simmons, B. et al. (2014) High-throughput prediction of eucalypt lignin syringyl/guaiacyl content using multivariate analysis: a comparison between mid-infrared, near-infrared, and Raman spectroscopies for model development. Biotechnology for Biofuels, 7(1).
85. Lupoi, J., Singh, S.Simmons, B. & Henry, R. (2014) Assessment of lignocellulosic biomass using analytical spectroscopy: an evolution to high-throughput techniques. Bioenergy Research, 7(1): 1-23.
86. Lyons, R.E., To Loan, N., Dierens, L., Fortes, M.R.S., Kelly, M., Mcwilliam, S.M., Li, Y., Bunch, R., Harrison, B.E., Barendse, W., Lehnert, S.A., and Moore, S.S. (2014). Evidence for positive selection of taurine genes within a QTL region on chromosome X associated with testicular size in Australian Brahman cattle. BMC Genetics 15.
87. Mace, E., Tai, S., Innes, D., Godwin, I., Hu, W., Campbell, B. et al. (2014) The plasticity of NBS resistance genes in sorghum is driven by multiple evolutionary processes. BMC Plant Biology, 14(1): 253.1-253.14.
88. Mahony, D., Cavallaro, A., Mody, K., Xiong, L., Mahony, T., Qiao, S. et al. (2014) In vivo delivery of bovine viral diahorrea virus, E2 protein using hollow mesoporous silica nanoparticles. Nanoscale, 6(12): 6617-6626.

89. Mann, K. & Dietzgen, R. (2014) Plant rhabdoviruses: new insights and research needs in the interplay of negative-strand RNA viruses with plant and insect hosts. Archives of Virology, 159(8): 1889-1900.
90. McIntyre, C., Rattey, A.Kilian, A. Dreccer, M. & Shorter, R. (2014) Preferential retention of chromosome regions in derived synthetic wheat lines: a source of novel alleles for wheat improvement. Crop and Pasture Science, 65(2): 125-138.
91. McLaren, T., Smernik, R.Guppy, C. Bell, M. & Tighe, M. (2014) The organic P composition of vertisols as determined by 31P NMR spectroscopy. Soil Science Society of America Journal, 78(6): 1893-1902.
92. McMullen, K., Rasmus, C.Virtue, M. Slik, K. & Wrigley, C. (2014) Cake flour is not just any old white powder: a fun take-home experiment. Teaching Science, 60(1): 43-49.
93. McTaggart, A., Geering, A. & Shivas, R. (2014) The rusts on Goodeniaceae and Stylidiaceae. Mycological Progress, 13(4): 1017-1025.
94. McTaggart, A., Geering, A. & Shivas, R. (2014) Uredinopsis pteridis and Desmella aneimiae, the first rust fungi (Pucciniales) reported on ferns (Pteridophyta) in Australia. Australasian Plant Disease Notes, 9(149): 1-4.
95. Meira, C., Farah, M., Fortes, M., Moore, S., Pereira, G., Silva, J. et al. (2014) A genome-wide association study for morphometric traits in quarter horse. Journal of Equine Veterinary Science, 34(8): 1028-1031.
96. Meira, CT; Farah, MM; Fortes, MRS; Moore, SS; Pereira, GL; Silva, JAV; da Mota, MDS; Curi, RA. 'A Genome-Wide Association Study for Morphometric Traits in Quarter Horse', Journal Of Equine Veterinary Science, Volume: 34, Issue: 8, Pp 1028-1031. Published: Aug 2014.
97. Miar, Y., Plastow, G.S., Moore, S.S., Manafiazar, G., Charagu, P., Kemp, R.A., Van Haandel, B., Huisman, A.E., Zhang, C.Y., McKay, R.M., Bruce, H.L., Wang, Z. (2014) Genetic and Phenotypic Parameters for Carcass and Meat Quality Traits in Commercial Crossbred Pigs. J. Anim. Sci doi: 10.2527/jas.2014-7685.
98. Merson, S., Ouwerkerk, D., Gulino, L., Klieve, A., Bonde, R., Burgess, E. et al. (2014) Variation in the hindgut microbial communities of the Florida manatee, Trichechus manatus latirostris over winter in Crystal River, Florida. FEMS Microbiology Ecology, 87(3): 601-615.
99. Mody, K., Mahony, D., Cavallaro, A., Stahr, F., Qiao, S., Mahony, T. et al. (2014) Freeze-drying of ovalbumin loaded mesoporous silica nanoparticle vaccine formulation increases antigen stability under ambient conditions. International Journal of Pharmaceutics, 465 (1-2): 325-332.
100. Mody, K., Mahony, D., Zhang, J., Cavallaro, A., Zhang, B., Popat, A. et al. (2014) Silica vesicles as nanocarriers and adjuvants for generating both antibody and T-cell mediated immune resposes to Bovine Viral Diarrhoea Virus E2 protein. Biomaterials, 35 (37): 9972-9983.
101. Morales-Erasto, V., Posadas-Quintana, J., Fernández-Díaz, M., Saravia, L., Martínez-Castañeda, J., Blackall, P. et al. (2014) An evaluation of serotyping of Avibacterium paragallinarum by use of a multiplex polymerase chain reaction. Journal of Veterinary Diagnostic Investigation, OnlineFirst (2): 1-6.
102. Morgan, J. & Urech, R. (2014) An improved real-time PCR assay for the detection of Old World screwworm flies. Acta Tropica, 138: S76-S81.
103. Naveed, K., Mitter, N.Harper, A. Dhingra, A. & Pappu, H. (2014) Comparative analysis of virus-specific small RNA profiles of three biologically distinct strains of Potato virus Y in infected potato (Solanum tuberosum) cv. Russet Burbank. Virus Research, 191: 153-160.
104. Nock, C., Elphinstone, M., Ablett, G., Kawamata, A., Hancock, W., Hardner, C. et al. (2014) Whole genome shotgun sequences for microsatellite discovery and application in cultivated and wild Macadamia (Proteaceae). Applications in Plant Sciences, 2(4).
105. Powell, P., Sullivan, M., Sweedman, M., Stapleton, D., Hasjim, J. & Gilbert, R. (2014) Extraction, isolation and characterisation of phytoglycogen from su-1 maize leaves and grain. Carbohydrate Polymers, 101(1): 423-431.
106. Omana, D.A., Goddard, E., Plastow, G.S., Janz, J., Ma, L., Anders, S., Moore, S.S., Bruce, H.L. (2014) Influence of on-farm production practices on sensory and technological quality characteristics of pork loin. Meat Science 96: 316-320.
107. Ramayo-Caldas, Y., Ballester, M., Fortes, M., Esteve-Codina, A., Castello, A., Noguera, J. et al. (2014) From SNP co-association to RNA co-expression: Novel insights into gene networks for intramuscular fatty acid composition in porcine. BMC Genomics, 15(1).
108. Ramayo-Caldas, Y., Fortes, M.R.S., Hudson, N.J., Porto-Neto, L. R., Bolormaa, S., Barendse, W., Kelly, M., Moore, S.S., Goddard, M.E., Lehnert, A., Reverter, A. (2014) A marker-derived gene network reveals the regulatory role PPARGC1A, HNF4G and FOXP3in intramuscular fat deposition of beef cattle. J Anim. Sci. Published online before print 28 April 2014, doi:10.2527/jas.2013-7484.

109. Rebetzke, Greg J., Fischer, Ralph (Tony) A., Van Herwaarden, Anthony F., Bonnett, Dave G., Chenu, Karine, Rattey, Allan R. and Fettell, Neil A. (2014) Plot size matters: Interference from intergenotypic competition in plant phenotyping studies. Functional Plant Biology, 41 2: 107-118. doi:10.1071/FP13177.
110. Rego, J., Crisp, J., Moura, A., Nouwens, A., Li, Y., Venus, B. et al. (2014) Seminal plasma proteome of electroejaculated Bos indicus bulls. Animal Reproduction Science, 148(1-2): 1-17.
111. Robinson, K., Worrall, E. & Mitter, N. (2014) Double stranded RNA expression and its topical application for non-transgenic resistance to plant viruses. Journal of Plant Biochemistry and Biotechnology, Online First (3): 1-7.
112. Rodriguez, D., Cox, H.deVoil, P. & Power, B. (2014) A participatory whole farm modelling approach to understand impacts and increase preparedness to climate change in Australia. Agricultural Systems, 126: 50-61.
113. Rosic, N., Ling, E., Chan, C., Lee, C., Kaniewska, P., Edwards, D. et al. (2014) Unfolding the secrets of coral-algal symbiosis. The ISME Journal.
114. Rossetto, Maurizio and Henry, Robert J. (2014) Escape from the laboratory: new horizons for plant genetics. Trends in Plant Science, 19 9: 554-555. doi:10.1016/j.tplants.2014.06.011.
115. Singh, M., Bhullar, M. & Chauhan, B. (2015) Seed bank dynamics and emergence pattern of weeds as affected by tillage systems in dry direct-seeded rice. Crop Protection, 67: 168-177.
116. Singh, R., Remington, B.Blackall, P. & Turni, C. (2014) Epidemiology of fowl cholera in free range broilers. Avian Diseases, 58(1): 124-128.
117. Singh, V., Nguyen, C.T., van Oosterom, E.J., Chapman, S.C., Jordan, D.R., and Hammer, G.L. (2015). Sorghum genotypes differ in high temperature responses for seed set. Field Crops Research 171: 32-40.
118. Sullivan, M., Aroney, S., Li, S., Warren, F., Joo, J., Mak, K. et al. (2014) Changes in glycogen structure over feeding cycle sheds new light on blood-glucose control. Biomacromolecules, 15(2): 660-665.
119. Sullivan, M., Powell, P., Witt, T., Vilaplana, F., Roura, E. & Gilbert, R. (2014) Improving size-exclusion chromatography separation for glycogen. Journal of Chromatography A, 1332: 21-29.
120. Sultan, B., Guan, K., Kouressy, M., Biasutti, M., Piani, C., Hammer, G. et al. (2014) Robust features of future climate change impacts on sorghum yields in West Africa. Environmental Research Letters, 9(10): 1-13.
121. Sultan, B., Guan, K., Kouressy, M., Biasutti, M., Piani, C., Hammer, G.L., McLean, G., and Lobell, D.B. (2014) Robust features of future climate change impacts on sorghum yields in West Africa. Environmental Research Letters, Volume 9, Issue 10, Article Number 104006 (13pp). doi:10.1088/1748-9326/9/10/104006
122. Sultanbawa, Y., Cozzolino, D., Fuller, S., Cusack, A., Currie, M. & Smyth, H. (2015) Infrared spectroscopy as a rapid tool to detect methylglyoxal and antibacterial activity in Australian honeys. Food Chemistry, 172: 207-212.
123. Sunarharum, W., Williams, D. & Smyth, H. (2014) Complexity of coffee flavor: A compositional and sensory perspective. Food Research International, 62: 315-325.
124. Swe, P., Zakrzewski, M.Kelly, A. Krause, L. & Fischer, K. (2014) Scabies mites alter the skin microbiome and promote growth of opportunistic pathogens in a porcine model. PLoS Neglected Tropical Diseases, 8(5): 1-12.
125. Sweedman, M., Hasjim, J.Schafer, C. & Gilbert, R. (2014) Structures of octenylsuccinylated starches: Effects on emulsions containing β-Carotene. Carbohydrate Polymers, 112: 85-93.
126. Tan, E., Fletcher, M.Yong, K. D'Arcy, B. & Al Jassim, R. (2014) Determination of hepatotoxic indospicine in Australian camel meat by ultra-performance liquid chromatography-tandem mass spectrometry. Journal of Agricultural and Food Chemistry, 62(8): 1974-1979.
127. Taylor, J., Doyle, D.Blackall, P. & Confer A. (2014) Use of REP-PCR and 16S rRNA gene sequencing for comparison of Mannheimia haemolytica isolates obtained from fatal cases of bovine respiratory disease in the USA and Australia. Australian Veterinary Journal, 92(1-2): 15-23.
128. Turni, C., Singh, R.Schembri, M. & Blackall, P. (2014) Evaluation of a multiplex PCR to identify and serotype Actinobacillus pleuropneumoniae serovars 1, 5, 7, 12 and 15. Letters in Applied Microbiology, 59(4): 362-369.
129. van Brunschot, S., Bergervoet, J., Pagendam, D., de Weerdt, M., Geering, A., Drenth, A. et al. (2014) A bead-based suspension array for the multiplexed detection of begomoviruses and their whitefly vectors. Journal of Virological Methods, 198: 86-94.
130. van Klinken, R., Panetta, F.Coutts, S. & Simon, B. (2014) Learning from the past to predict the future: an historical analysis of grass invasions in northern Australia. Biological Invasions, Online First.
131. Vilaplana, F., Meng, D.Hasjim, J. & Gilbert, R. (2014) Two-dimensional macromolecular distributions reveal detailed architectural features in high-amylose starches. Carbohydrate Polymers, 113: 539-551.
132. Wang, B., Sun, W., Li, Q., Li, Y., Luo, H., Song, J. et al. (2014) Genome-wide identification of phenolic acid biosynthetic genes in Salvia miltiorrhiza. Planta.
133. Wang, D., Chen, S., Wang, Z., Ji, C., Xu, C., Zhang, X. et al. (2014) Optimizing hill seeding density for high-yielding hybrid rice in a single rice cropping system in South China. PLoS One, 9(10).

Wang, E., Bell, M.Luo, Z. Moody, P. & Probert, M. (2014) Modelling crop response to phosphorus inputs and phosphorus use efficiency in a crop rotation. Field Crops Research, 155: 120-132.
134. Wang, K., Henry, R. & Gilbert, R. (2014) Causal relations among starch biosynthesis, structure, and properties. Springer Science Reviews, 2(1-2): 15-33.
135. Wang, Kai, Hasjim, Jovin, Chi Wu, Alex, Henry, Robert J. and Gilbert, Robert G. (2014) Variation in amylose fine structure of starches from different botanical sources. Journal of Agricultural and Food Chemistry, 62 19: 4443-4453. doi:10.1021/jf5011676
136. Williams, D., Edwards, D.Pun, S. Chaliha, M. & Sultanbawa, Y. (2014) Profiling ellagic acid content: the importance of form and ascorbic acid levels. Food Research International, 66: 100-106.
137. Woodford, L., Fletcher, M. & Boardman, W. (2014) Suspected pyrrolizidine alkaloid hepatotoxicosis in wild southern hairy-nosed wombats (Lasiorhinus latifrons). Journal of Agricultural and Food Chemistry, 62(30): 7413-7418.
138. Wu, A., Ral, J.Morell, M. & Gilbert, R. (2014) New perspectives on the role of α- and β-amylases in transient starch synthesis. PLoS One, 9(6): e100498.1-e100498.10.
139. Zhang, B., Wang, K., Hasjim, J., Li, E., Flanagan, B., Gidley, M. et al. (2014) Freeze-drying changes the structure and digestibility of B-polymorphic starches. Journal of Agricultural and Food Chemistry, 62(7): 1482-1491.
140. Zhang, C.Y., Wang, Z., Bruce, H.L., Janz, J., Goddard, E., Moore, S., Plastow, G.S. (2014) Associations between single nucleotide polymorphisms in 33 candidate genes and meat quality traits in commercial pigs. Animal Genetics Article first published online: 7 April 2014 DOI: 10.1111/age.12155.
141. Zhang, J., Karmakar, S., Yu, M., Mitter, N., Zou, J. & Yu, C. (2014) Synthesis of silica vesicles with controlled entrance size for high loading, sustained release, and cellular delivery of therapeutical proteins. Small, 10(24): 5068-5076.
142. Zhao, L., Seth, A., Wibowo, N., Zhao, C., Mitter, N., Yu, C. et al. (2014) Nanoparticle vaccines. Vaccine, 32(3): 327-337.
143. Zhou, Y., Grof, C. & Patrick, J. (2014) Proof of concept for a novel functional screening system for plant sucrose effluxers. Journal of Biological Methods, 1(2): e5.1-e5.6.
144. Zhou, Y., Pan, X.Qu, H. & Underhill, S. (2014) Low temperature alters plasma membrane lipid composition and ATPase activity of pineapple fruit during blackheart development. Journal of Bioenergetics and Biomembranes, 46(1): 59-69.
145. Zhou, Y., Pan, X.Qu, H. & Underhill, S. (2014) Tonoplast lipid composition and proton pump of pineapple fruit during low-temperature storage and blackheart development. Journal of Membrane Biology, 247(5): 429-439.
146. Zhou, Y., Taylor, M. & Underhill, S. (2014) Dwarfing of Breadfruit (Artocarpus altilis) Trees: Opportunities and Challenges. American Journal of Experimental Agriculture, 4(12): 1743-1763.
147. Ziems, L., Hickey, L., Hunt, C., Mace, E., Platz, G., Franckowiak, J. et al. (2014) Association mapping of resistance to Puccinia hordei in Australian barley breeding germplasm. Theoretical and Applied Genetics, 127(5): 1199-1212.

CONFERENCE PAPERS

1. Castells, L., McNeill, D., Dixon, R., Kidd, L., Fletcher, M. & Goodwin, K. (2014). Phosphorous supplements in pregnancy improve lactation performance of young cows. In S. Hatcher, G. L. Krebs, B. W. B. Holman (Eds.), Joint ISNH/ISRP International Conference 2014: Harnessing the Ecology and Physiology of Herbivores. Joint ISNH/ISRP International Conference 2014: Harnessing the Ecology and Physiology of Herbivores, Canberra, ACT, Australia, (335-335). 8-12 Sep 2014.
2. Fletcher, M., Tan, E. & Silcock, R. (2014). Indigofera linnaei - a problem legume across northern pastures. In S. Hatcher, G. L. Krebs, B. W. B. Holman (Eds.), Joint ISNH/ISRP International Conference 2014: Harnessing the Ecology and Physiology of Herbivores. Joint ISNH/ISRP International Conference 2014: Harnessing the Ecology and Physiology of Herbivores, Canberra, ACT, Australia, (285-285). 8-12 Sep 2014.
3. Hammer, Graeme (2014) Molecular breeding for complex adaptive traits – can crop ecophysiology and modelling ease the pain? Paper presented at the XXVIII Congress of the International Society of Sugar Cane Technologists, Sao Paulo, Brazil, 24-27 June 2013. (International Sugar Journal (2014) 116:64-68).
4. Navarro, M., Stanley, R.Cusack, A. & Sultanbawa, Y. (2013). Rapid in vitro antimicrobial screening assay against Campylobacter. In 24th Annual Australian Poultry Science Symposium. 24th Annual Australian Poultry Science Symposium, Sydney, NSW, Australia, (241-241). 17-20 Feb, 2013.
5. Potgieter, A., Rodriguez, D.Power, B. Mclean, J. & Davis, P. (2014). Seeing is believing I: the use of thermal sensing from satellite imagery to predict crop yield. In IOP Conference Series: Earth and Environmental Science. ISDE 2013: The 8th International Symposium On Digital Earth, Kuching, Sarawak, Malaysia, (012118.1-012118.8). 26-28 Aug 2013.

Appendix D

QAAFI SCIENCE SEMINARS

Throughout 2014, QAAFI hosted more than 40 science seminars disseminating a broad range of research-based information across the plant, animal, nutrition and food sciences.

11 Feb – Prof. Robert Henry, QAAFI Director
Plants to feed and fuel the planet: contributions from Queensland to global food and energy security

18 Feb – Dr James Kijas, Principal Research Scientist, CSIRO Animal, Food and Health Sciences
Sequencing sheep genomes to uncover the consequences of domestication and selection

25 Feb – Dr Eugeni Roura, Senior Research Fellow, Centre for Nutrition & Food Sciences, QAAFI
Taste diversity and the control of appetite

3 March – A/Prof. Tim Mahony, Principal Research Fellow, Centre for Animal Science, QAAFI
Future biosecurity strategies for the Australian beef industry

4 March – Prof. Graeme Hammer, Director of the Centre for Plant Science, QAAFI
Molecular breeding for complex adaptive traits in crop plants

11 March – Dr Jun-Mo Kim, Postdoctoral Fellow, Centre for Nutrition & Food Sciences, QAAFI
Porcine muscle fibre characteristics as new selection criteria and candidate gene approach

18 March – Dr Jim Hanan, Principal Research Fellow, Centre for Plant Science, QAAFI
Functional Structural Plant Modelling: Applications in the plant and beyond

25 March – Prof. Michael Rychlik, Head of the Chair of Analytical Food Chemistry, R&D Division, Bioanalytics Department, Technische Universität München, Germany
Stable isotopes and their applications in food and nutrition sciences

1 April – Dr Gene Wijffels, Research Program Leader, Integrated Mammalian Biology, CSIRO
Gut integrity and stress in ruminants

2 April - Prof. Dorian Fuller, Institute of Archaeology, University College London, UK
Comparing Pathways to Agriculture in Asia

8 April – Dr Bronwyn Laycock, Senior Research Fellow, School of Chemical Engineering, UQ
Bio-derived polymer films: Applications in the food supply chain

15 April – Prof. Christine Beveridge, School of Biological Sciences, UQ and Affiliated Professor, Centre for Plant Science (QAAFI)
Apical dominance maintained by sugar limitation

29 April – Dr Scott Chapman, Senior Principal Research Scientist (CSIRO), QAAFI Adjunct Professor
The psychology of drought stress response in crops

6 May – Dr Yasmina Sultanbawa, Senior Research Fellow, Centre for Nutrition & Food Sciences, QAAFI
Technological strategies to improve safety of fresh food

13 May – A/Prof. David Lobell, Stanford University, USA
The search for climate adaptive crop traits

16 May –Prof. Lluis Serra-Majem, Universidad de Las Palmas de Gran Canaria, Dept Clinical Sciences, Las Palmas, Spain
Mediterranean Diet: a cultural, healthy and sustainable dietary pattern

20 May – Dr Stuart McLennan, Principal Research Fellow, Centre for Animal Science, QAAFI
Nutrition research for increased growth of beef cattle in northern Australia

20 May – Prof. Dennis Poppi, Professor of Animal Nutrition, School of Agriculture and Food Sciences, UQ
Nutrition research for increased growth of beef cattle in northern Australia

27 May – Prof. Peter M. Gresshoff, Professor in Plant Molecular Genetics, Director Centre for Integrative Legume Research
Molecular Genetics of Nodulation Control in Legumes

30 May – Dr Neeti Sanan Mishra, Research Scientist, International Centre for Genetic Engineering and Biotechnology, India
Genomics of microRNA in rice development and environmental adaptation

3 June – Dr Marcus Gray, NHMRC Australian Clinical Research Fellow, Centre for Advanced Imaging, UQ
Predicting the body: autonomic regulation and emotion

10 June – Prof. Mark Schembri, Professor and ARC Future Fellow, School of Chemistry and Molecular Biosciences, UQ
Molecular characterisation of a multi-drug resistant globally disseminated E.coli clone

10 June – Omar Mendoza-Porras, PhD Candidate, Flinders University, Adelaide
Molecular assessment of spawning cues in temperate abalone *Haliotis laevigata*

17 June – Prof. Peer Schenk, School of Agriculture and Food Sciences (UQ), QAAFI Affiliated Professor, Centre for Plant Science and Centre for Nutrition & Food Sciences
Biofuel production from algae and other plant biotech experiments to address food and energy security

24 June – Prof. Susanne Schmidt, Teaching and Research Academic – Plant Science, UQ School of Agriculture and Food Sciences
Nutrient pollution in agriculture: where to from here?

5 August – Prof. Rod Snowdon, Chair of Plant Breeding, Department of Agronomy and Plant Breeding
Justus Liebig University, Giessen, Germany
Genomic dissection of trait complexity for crop improvement

19 Aug – Prof. Michael McGowan, School of Veterinary Science, UQ
Improving the profitability and sustainability of beef cattle production in northern Australia

26 Aug – Dr Jovyn Ng, Post-Doctoral Fellow, Plant & Food Research, New Zealand
Potato cell wall structure and starch analyses in cultivars with different digestibilities

2 Sep – Dr Andrew Geering, Senior Research Fellow, Centre for Plant Science, QAAFI
Ensuring the 'bent bananas' are rejected by applying novel virus diagnostic strategies

9 Sep – Prof. Stephen Moore, Director of the Centre for Animal Science, QAAFI
What's the Beef - Bovine Genomics in Northern Australia?

16 Sep – Dr Linda Lua, Director of UQ Protein Expression Facility, Australian Institute for Bioengineering and Nanotechnology
The protein challenge

23 Sep – Dr Paraic O'Cuiv, Research Fellow, Faculty of Medicine and Biomedical Sciences,
The University of Queensland Diamantina Institute
The healthy microbiome are we there yet?

7 Oct – Dr Kemal Kazan, Senior Principal Research Scientist (CSIRO), Agriculture Flagship, Honorary Professor (QAAFI)
What we know and don't know about *Fusarium* pathogens

14 Oct – Dr Elizabeth Aitken, Associate Professor (SAFS), Affiliate Associate Professor (QAAFI)
Banana *Fusarium* wilt: an on-going battle

21 Oct – Dr Daniel Waters, Research Fellow, Southern Cross University
Rice grain storage protein composition

21 Oct – Dr Lei (Ben) Liu, Research Fellow, Southern Cross University
Searching for a rice to control diabetes

28 Oct – Dr Lee Hickey, Research Fellow, Centre for Plant Science, QAAFI
The Speed Breeding journey: from garbage bins to Bill Gates

4 Nov – Prof. Mike Gidley, Director of the Centre for Nutrition & Food Sciences, QAAFI
Health and wealth from foods - challenges and opportunities

11 Nov – Prof. Neal Menzies, Head of School and Dean of Agriculture, School of Agriculture and Food Sciences, UQ
The challenge of predicting metal transfer through the soil-plant-animal continuum

18 Nov – Dr Mary Fletcher, Senior Research Fellow, Centre for Animal Science, QAAFI
Controlling Aflatoxin to improve food safety

18 Nov – Dr Rao (RCN) Rachaputi, Senior Research Fellow, Centre for Plant Science, QAAFI
Management of Aflatoxin in Australian Peanut Industry

2 Dec – Greg George, Librarian, Research Information Service, UQ Library
Managing researcher author identity

9 Dec – Dr Ralf Dietzgen, Principal Research Fellow, Centre for Plant Science, QAAFI
Rhabdoviruses and related pathogens in agriculture

Appendix E

QAAFI ACADEMIC STAFF, ADJUNCTS & AFFILIATES

QAAFI Academic Staff

Surname	First Name	Position Description	Org Unit
Akinsanmi	Olufemi	Senior Research Officer	Plant Science
Armour	David	Research Officer	Plant Science
Armstrong	Robert	Research Officer	Plant Science
Auzmendi	Inigo	Postdoctoral Research Fellow	Plant Science
Bell	Mike	Professor	Plant Science
Benvenutti	Marcelo	Research Fellow	Animal Science
Blackall	Patrick	Principal Research Fellow	Animal Science
Borrell	Andrew	Principal Research Fellow	Plant Science
Burns	Brian	Senior Research Fellow	Animal Science
Chauhan	Bhagirath	Principal Research Fellow	Plant Science
Chenu	Karine	Research Fellow	Plant Science
Christopher	John	Research Fellow	Plant Science
Chu	Shang	Research Officer	Nutrition & Food Sciences
Constantin	Myrna	Postdoctoral Research Fellow	Plant Science
Dann	Elizabeth	Senior Research Fellow	Plant Science
De Jager	Nadia	Research Officer	Nutrition & Food Sciences
Dhital	Sushil	Postdoctoral Research Fellow	Nutrition & Food Sciences
Dietzgen	Ralf	Principal Research Fellow	Plant Science
Dixon	Robert	Senior Research Fellow	Animal Science
Drenth	Andre	Professor	Plant Science
Eyre	Joseph	Research Fellow	Plant Science
Ferrante	Ariel	Research Officer	Plant Science
Flanagan	Bernadine	Postdoctoral Research Fellow	Nutrition & Food Sciences
Fletcher	Mary	Senior Research Fellow	Animal Science
Fordyce	Geoffry	Senior Research Fellow	Animal Science
Fox	Glen	Senior Research Fellow	Nutrition & Food Sciences
Furtado	Agnelo	Senior Research Fellow	Nutrition & Food Sciences
Geering	Andrew	Senior Research Fellow	Plant Science
George-Jaeggli	Barbara	Research Fellow	Plant Science
Gidley	Mike	Institute Centre Director	Nutrition & Food Sciences
Gilbert	Robert	Professorial Research Fellow	Nutrition & Food Sciences

Godwin	Rosamond	Postdoctoral Research Fellow	Animal Science
Gunness	Purnima	Research Officer	Nutrition & Food Sciences
Hammer	Graeme	Institute Centre Director	Plant Science
Hanan	James	Principal Research Fellow	Plant Science
Hardner	Craig	Senior Research Fellow	Plant Science
Hathorn	Adrian	Postdoctoral Research Fellow	Plant Science
Hayward	Alice	Research Fellow	Plant Science
Henderson	Juliane	Research Fellow	Plant Science
Henry	Robert	Institute Director	QAAFI
Hickey	Lee	Research Fellow	Plant Science
James	Peter	Senior Research Fellow	Animal Science
Jordan	David	Professor	Plant Science
Kelly	Matt	Senior Research Fellow	Animal Science
Kim	Jun-Mo	UQ Postdoc Research Fellow	Nutrition & Food Sciences
Lew-Tabor	Alicja	Associate Professor	Animal Science
Lopez-Sanchez	Patricia	Research Fellow	Nutrition & Food Sciences
Mahony	Timothy	Associate Professor	Animal Science
Martinez Sanz	Marta	Postdoctoral Research Fellow	Nutrition & Food Sciences
McLennan	Stuart	Principal Research Fellow	Animal Science
Mikkelsen	Deirdre	Postdoctoral Research Fellow	Nutrition & Food Sciences
Miles	Andrew	Senior Research Fellow	Plant Science
Mitter	Neena	Associate Professor	Plant Science
Moore	Stephen	Institute Centre Director	Animal Science
Morgan	Jessica	Research Fellow	Animal Science
Netzel	Michael	Senior Research Fellow	Nutrition & Food Sciences
Nirmal	Nilesh	UQ Postdoctoral Research Fellow	Nutrition & Food Sciences
O'Hare	Timothy	Senior Research Fellow	Nutrition & Food Sciences
Petherick	Carol	Senior Research Fellow	Animal Science
Potgieter	Andries	Research Fellow	Plant Science
Rachaputi	Nageswararao	Senior Research Fellow	Plant Science
Raghuwanshi	Anshu	Research Officer	Animal Science
Robinson	Karl	Research Officer	Plant Science
Rodriguez	Daniel	Senior Research Fellow	Plant Science
Rodriguez Valle	Manuel	Senior Research Fellow	Animal Science
Roura	Eugeni	Snr Research Fellow/Snr Lecturer	Nutrition & Food Sciences
Singh	Vijaya	UQ Post Doc Research Fellow	Plant Science
Singh	Dharmendra	UQ Postdoc Research Fellow	Plant Science

Smyth	Heather	Senior Research Fellow	Nutrition & Food Sciences
Sultanbawa	Yasmina	Senior Research Fellow	Nutrition & Food Sciences
Swift	Roger	Professor	Plant Science
Tao	Yongfu	Postdoctoral Research Fellow	Plant Science
Thomas	John	Principal Research Fellow	Plant Science
Topp	Bruce	Principal Research Fellow	Plant Science
Turni	Cornelia	Research Fellow	Animal Science
Underhill	Steven	Associate Professor	Plant Science
Van Oosterom	Erik	Senior Research Fellow	Plant Science
Warren	Frederick	Postdoctoral Research Fellow	Nutrition & Food Sciences
Watson	James	Postdoctoral Research Fellow	Plant Science
Williams	Barbara	Senior Research Fellow	Nutrition & Food Sciences
Wu	Chung-Chi	Postdoctoral Research Fellow	Plant Science
Wu	Luguang	Senior Research Fellow	Plant Science
Zhou	Yuchan	Research Officer	Plant Science

QAAFI Adjuncts & Affiliates

Surname	First Name	Position Description	Org Unit
Adamson	David	Affiliated Academic Level C	Plant Science
Adkins	Stephen	Affiliated Academic Level E	QAAFI
Aitken	Elizabeth	Affiliated Academic Level D	QAAFI
Anderson	Stephen	Affiliated Academic Level C	QAAFI
Bally	Ian	Adjunct Associate Professor	Plant Science
Banks	Phillip	Adjunct Associate Professor	QAAFI
Barker	Stephen	Affiliated Academic Level D	QAAFI
Barnard	Ross	Affiliated Academic Level E	QAAFI
Basford	Kaye	Affiliated Academic Level E	QAAFI
Beveridge	Christine	Affiliated Academic Level D	Plant Science
Blakeney	Anthony	Adjunct Associate Professor	QAAFI
Blaney	Barry	Adjunct Fellow	QAAFI
Botella	Jose	Affiliated Academic Level E	Plant Science
Botha	Frederik	Honorary Professor	QAAFI
Brown	Melissa	Affiliated Academic Level E	QAAFI
Bryden	Wayne	Affiliated Academic Level E	QAAFI
Butler	David	Adjunct Associate Professor	Plant Science
Carroll	Bernard	Affiliated Academic Level D	QAAFI
Cawdell-Smith	Alison	Affiliated Academic Level B	QAAFI

Chapman	Scott	Honorary Professor	QAAFI
Chen	Steven	Honorary Professor	QAAFI
D'Arcy	Bruce	Affiliated Academic Level C	QAAFI
Dargusch	Paul	Affiliated Academic Level B	QAAFI
Dieters	Mark	Affiliated Academic Level C	QAAFI
Eisemann	Robert	Adjunct Associate Professor	QAAFI
Fortes	Marina	Affiliated Academic Level B	QAAFI
Fukai	Shu	Affiliated Academic Level E	QAAFI
Furlong	Michael	Affiliated Academic Level C	QAAFI
Galea	Victor	Affiliated Academic Level D	Plant Science
Gaughan	John	Affiliated Academic Level C	QAAFI
Gilbert	Rosalind	Adjunct Fellow	QAAFI
Gillam	Elizabeth	Affiliated Academic Level E	QAAFI
Godwin	Ian	Affiliated Academic Level E	QAAFI
Gulino	Lisa-Maree	Adjunct Fellow	QAAFI
Hardy	Margaret	Affiliated Academic Level E	QAAFI
Harvey	Jagger	Adjunct Fellow	QAAFI
He	Yingbin	Adjunct Associate Professor	QAAFI
Herrero	Mario	Honorary Professor	QAAFI
Jorgensen	Wayne	Adjunct Associate Professor	QAAFI
Kazan	Kemal	Honorary Professor	QAAFI
Kelly	Alison	Adjunct Associate Professor	QAAFI
Kharabian-Masouleh	Ardashir	Adjunct Fellow	QAAFI
Konczak	Izabela	Adjunct Fellow	QAAFI
Kriticos	Darren	Adjunct Associate Professor	Animal Science
Lambrides	Christopher	Affiliated Academic Level C	Plant Science
Lee	Slade	Adjunct/Conjoint/Honorary	QAAFI
Li	Xiuhua	Affiliated Academic Level B	QAAFI
Lindberg Moller	Birger	Honorary Professor	QAAFI
Luksiene	Zivile	Adjunct Associate Professor	QAAFI
Lupoi	Jason	Adjunct Fellow	QAAFI
Mace	Emma	Adjunct Associate Professor	Plant Science
Mackay	Michael	Adjunct/Conjoint/Honorary	QAAFI
McGowan	Michael	Affiliated Academic Level E	QAAFI
McNeill	David	Affiliated Academic Level C	QAAFI
Meers	Joanne	Affiliated Academic Level D	QAAFI
Menzies	Neal	Affiliated Academic Level E	QAAFI

Mereddy	Kodanda	Adjunct Fellow	Nutrition & Food Sciences
O'Shea	Michael	Adjunct Fellow	QAAFI
Ossedryver	Selina	Adjunct Fellow	QAAFI
Ouwerkerk	Diane	Adjunct Fellow	QAAFI
Periyannan	Sambasivam	Adjunct Associate Professor	Plant Science
Poppi	Dennis	Affiliated Academic Level E	QAAFI
Poulsen	David	Adjunct Associate Professor	QAAFI
Quigley	Simon	Affiliated Academic Level B	Animal Science
Rossetto	Maurizio	Honorary Professor	QAAFI
Schenk	Peer	Affiliated Academic Level D	Plant Science
Schmidt	Susanne	Affiliated Academic Level D	Plant Science
Shapter	Frances	Adjunct Fellow	QAAFI
Shelton	Harry	Affiliated Academic Level D	QAAFI
Silcock	Richard	Adjunct Fellow	QAAFI
Simmons	Blake	Adjunct Associate Professor	QAAFI
Simon	Bryan	Adjunct Fellow	QAAFI
Skerritt	John	Adjunct Associate Professor	QAAFI
Sonni	Francesca	Adjunct Fellow	QAAFI
Sopade	Peter	Adjunct Fellow	Nutrition & Food Sciences
Steadman	Kathryn	Affiliated Academic Level D	QAAFI
Swift	Roger	Emeritus Professor	QAAFI
Taware	Santosh	Adjunct Fellow	QAAFI
Turner	Mark	Affiliated Academic Level C	QAAFI
Vilaplana	Francisco	Adjunct Fellow	Nutrition & Food Sciences
White	Neil	Adjunct Associate Professor	QAAFI
Wilkie	John	Adjunct Associate Professor	Plant Science
Wright	Graeme	Adjunct Associate Professor	QAAFI
Wright	Olivia	Affiliated Academic Level B	QAAFI
Wrigley	Colin	Honorary Professor	QAAFI

ANNUAL ALLIANCE RESEARCH PLAN for 2014/15

Centre for Plant Science (CPS) Research Plan

QAAFI Centre Director – Prof Graeme Hammer: Signature:

DAFF General Managers – Michael Kennedy (Horticulture), Signature:

Garry Fullelove (Field Crops) Signature:

Approved by the ARC: 18/8/2014

1. Justification for Government investment in the QAAFI Centre for Plant Science

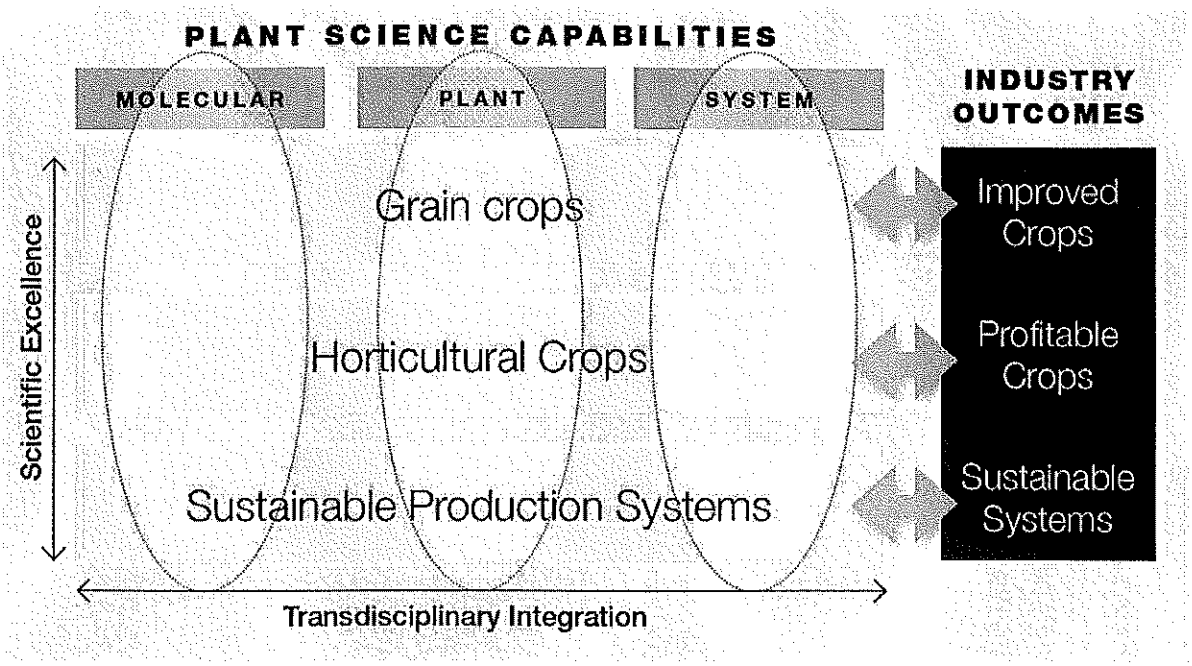
Effective Research, Development and Extension (RD&E) in primary industries is a key factor for increasing productivity and ensuring sustainability. QAAFI's focus is on expanding Queensland's rural R&D effort and capability to maximise national and international linkages, and improve industry effectiveness and efficiency. It pursues this goal by investing in high impact research areas, and encouraging uptake of research results to improve rural industry competitiveness and sustainability.

Plant-based industries make a significant contribution to the Queensland economy. Together field crop and horticultural industries contributed $5.5 billion (farm gate value) to the Queensland economy in 2012-13. Over 1.5 million hectares are farmed in grains, cotton and pulses. Grain industries in Queensland underpin the $3.8 billion local intensive livestock industries as well as national and international food markets dependent on grain. Sorghum, barley and wheat provide the major supply of grain to these markets. Horticultural industries comprise a large number of fruit and vegetable commodities. The industries have shown significant growth over many years, and have the potential to continue to grow with export potential into new and existing markets. The Government of Queensland has set a target of doubling the state's agricultural production by 2040 and the plant-based industries will be major contributors. These industries are significant employers and contributors to the economy, and underpin viability of many rural and regional areas throughout Queensland.

Beyond Queensland-based industries, there is an emerging need at national and international levels for enhanced effort in outcome-focussed plant science. Well-adapted plants and production systems are required to deliver the higher levels of profitable, sustainable, and secure production now required to meet national and global challenges.

The Centre for Plant Science (CPS) is one of the research centres forming the Queensland Alliance for Agriculture and Food Innovation (QAAFI). CPS links excellence in the discovery and development plant science capabilities of UQ and DAFF to deliver science-based solutions and outcomes for plant industries and associated community benefits via –

- improved and profitable grain crops,
- improved and profitable horticultural crops, and
- sustainable production systems.



The combined and complementary strengths of the two parent organisations ensure high levels of scientific, logistic, teaching, infrastructure and financial leverage. Since its establishment in October 2010 via a grant to UQ to support salaries of 18 lead scientists from DAFF to initiate the Centre as part of the broader QAAFI research alliance, CPS has grown to now include 33 academic staff, 9 support staff, and over 70 postgraduate students with CPS principal supervisors. These staff are engaged in a range of targeted, industry-relevant research projects, often in close collaboration with DAFF. In the 2014/15 financial year, these projects will involve external grant funding of over $12M.

CPS will increasingly play a fundamental role in contributing to new (skilled) jobs, sustainable economic development, prosperity and improved lifestyles.

2. Medium Term Outlook for the Government investment for the Research in CPS

CPS seeks to generate new discoveries in plant sciences and develop practical innovative technologies and processes that lead to improved productivity and international competitiveness within Queensland and Australia's food and fibre industries. CPS will have a strong focus on excellence in learning, discovery, and engagement by offering valuable and unique cross disciplinary study opportunities to the next generation of plant and agricultural scientists, by achieving this in a participatory framework with key industry partners, and by linking existing research strengths in discovery and development plant science.

CPS addresses the need to develop better adapted plants and production systems to deliver the higher levels of profitable, sustainable, and secure production now required to meet the national and global challenges of this century.

The three focal research program areas of CPS, each housing a number of innovative and focussed research teams:

I. Grain crops - Targeting improved productivity, quality and production efficiency in key grain crops (sorghum, wheat, barley, legumes).

II. Horticultural crops - Targeting improved quality, productivity and production efficiency in key horticultural crops (macadamia, banana, avocado, mango, and vegetables).

III. Sustainable production systems - Targeting improved resilience, sustainability and profitability of broad acre dry land and irrigated farming systems in the sub tropics and tropics.

These targeted programs will deliver strong economic growth in a medium term outlook by providing technologies and solutions to industry. CPS research will interface with product quality research in CNAFS and animal production research in CAS to deliver a co-ordinated and integrated effort across

QAAFI. The CPS partnership will facilitate the integration of relevant expertise from a diverse range of Institute, Faculty and School-associated research groups at UQ with plant science innovation leaders from within DAFF to address these needs and opportunities.

3. Criteria to be achieved from the Government investment for the Research in CPS

- Integration of relevant disciplinary capabilities across UQ and DAFF to deliver collaborative research outcomes that value add to Government investment
- Leadership of strategic research and development from within the Centre with facilitation of association between discovery and development science via close engagement with DAFF, other relevant agencies, industry, and community of practice.
- Activities focussed on areas where there is competitive advantage for Queensland and Queensland industry impact in alignment with the National RD&E Strategies for horticulture, grains and cotton.
- Encouragement of innovation and attraction / retention of high quality staff using appropriate incentives

4. Risk Assessment for the Government investment for the Research in CPS

The risk of a reduced technical capacity to innovate in the sector is high, in part because the attractiveness of the traditional plant science disciplines to talented school leavers has steadily diminished over the past decade, and the lack of renewal of expertise within Government. Thus one role of the Centre will be to encourage and facilitate engagement of postgraduate and postdoctoral scientists to work with senior scientists in CPS. This mentoring will be one avenue to support development of technical expertise needed for the future and minimise impact of generational change.

5. Research Objectives, Outcomes, outputs and associated projects.

Over-arching objectives for each of the three focal research program areas in CPS are given below and specific details on objectives and deliverables for the research teams within these programs for 2014-15 are attached -

I. Grain crops

Objective – to improve productivity, quality and production efficiency in key Queensland grain crops (sorghum, wheat, barley, legumes)

Targeted Outcomes:

- Increased productivity and profitability
- Improved varieties that combine abiotic and biotic stress tolerances
- Enhanced and cost effective management systems
- Improved breeding efficiency

Significance to Queensland:
The research will help to increase productivity growth of major crops, enhance grower profitability, and underpin delivery of economic growth.

Research focal areas:

- Sorghum crop improvement
- Winter cereal crop improvement
- Legume crop improvement

II. Horticultural crops

Objective – to improve quality, productivity and production efficiency in key Queensland horticultural crops (macadamia, banana, avocado, mango, and vegetables).

Targeted Outcomes -

- Increased productivity, profitability, and export
- Improved varieties that combine disease resistance, product quality and productivity
- Improved or enhanced quality, taste, nutrition and appearance depending on market demands
- Enhanced management of pests and diseases
- Cost effective management systems
- Protection from exotic pests and diseases
- Improved breeding efficiency

Significance to Queensland:
The research will help to increase productivity growth of major horticultural crops, enhance grower profitability, enhance disease management and biosecurity, and underpin delivery of economic growth.

Research focal areas:

- Sub-tropical fruit tree crop improvement
- Horticultural plant protection

III. Sustainable production systems

Objective – to improve resilience, sustainability and profitability of broad acre dry land and irrigated farming systems in the sub tropics and tropics

Targeted Outcomes -

- Farming systems designed to better deal with biotic, abiotic, climate and market risks
- Farmers using systems that deliver increased input use efficiency
- Farmers managing the reserves and cycling of soil nutrients and carbon to maintain soil functionality and minimise off site impacts
- Profitable grain and pasture legume options
- Farmers managing weed and soil biology problems better
- Opportunities for novel crops explored

Significance to Queensland:
The research will help to increase resilience, sustainability, and profitability of production and farming systems.

Research focal areas:

- Farming systems
- Soil health
- Weed management

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Sorghum Crop Improvement

85.

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
D Jordan **A Borrell** **G Hammer** **$548,588**	**Sorghum Crop Improvement** QAAFI and its collaborators use cutting edge science in genetics, physiology and modelling to pursue novel adaptive traits and management systems to increase the productivity, profitability and potential growth of the $500 million Queensland sorghum industry. Success of this program should result in a 2% annual increase in seasonally adjusted productivity and a 3% expansion of production into new growing areas over the next 10 years.	Key deliverables towards the objective in 2014-15 I. A minimum of 10 advanced lines licensed by seed industry by July 2015. II. Genetic regions associated with key traits (eg grain quality, disease resistance, drought resistance) identified by July 2015. III. Evaluate new experimental breeding lines in field trials spanning the major sorghum growing regions in Qld by July 2015 IV. Develop and phenotype fine-mapping populations for three new stay-green regions (StgA, Stg3b & StgC) by July 2015 V. A phenotyping platform experiment conducted by July 2015 to assess variation in transpiration efficiency in a sorghum mapping population. VI. A phenotyping platform established by July 2015 to asses variation in root architecture in sorghum populations VII. An analysis of potential value of breeding for specific adaptation in sorghum in Australia		1. Resource Availability - New genotypes and management systems to support potential expansion of sorghum growing regions 2. Productivity - Crop improvement will result in new varieties and management systems with increased yield and resilience to biotic and abiotic stresses 3. Markets - N/A 4. Production costs N/A

		TOTAL APPROVED	2014/15
ARC Linkage Project	Fertility Crisis: harnessing the genomic tension behind pollen fertility in sorghum (2013-16)	$ 462,500	$ 148,500
Generation Challenge Program Grant	Development and evaluation of drought-adapted sorghum germplasm for Africa and Australia - Phase II (2012-14)	$ 348,918	$ 171,884
Bill & Melinda Gates Foundation	A targeted approach to sorghum improvement in moisture stress areas of Ethiopia (2012-17)	$ 3,990,198	$ 986,654
Grains Research & Devel Corporation	Sorghum core breeding project (2013-17)	$ 1,775,016	$ 750,000
Grains Research & Development Corporation	Crop modelling support for the Australian grains industry (2012-15)	$ 264,000	$ 80,000
UQ Postdoctoral Fellowship	Designing root systems for drought adaptation in sorghum (2012-15)	$ 290,521	$ 95,174
UQMEI	Phenotype Sensing Platform (PSP) to Enhance Plant Breeding (2014)	$ 129,000	$ 129,000

18/03/2015

QAAFI Annual Research Plans – Deliverables for 2014/15
Centre for Plant Science – Sorghum Crop Improvement

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding				Alignment to Qld's Ag Strategy and/or RD&E Plan
		completed, published and presented to industry by July 2015. VIII. By July 2015, at least 3 publications and 3 presentations providing evidence of an improved understanding and modelling of drought adaptation, completion of one postgraduate student and initiation of one (in summer cereals). IX. Conduct a nationally coordinated sorghum research meeting that brings together scientists, industry, and research investors to extend and ensure delivery of research discoveries X. Initiate activities towards enhanced understanding and modelling of genetic variation in photosynthesis in sorghum by July 2015 as part of new ARC Centre of Excellence with ANU	DAFF	Evaluation of Australian Grain Sorghum Germplasm in the US. Agreement between the United Sorghum Checkoff Program Board and the State of Qld through DAFF (2011-14)	$ 20,000	$ 20,000	
			ARC	ARC Centre of Excellence for Translational Photosynthesis (2014-2020)	$ 4,120,928	$ 586,286	
			ARC	Centre of Excellence: QAAFI/UQ Co-Contribution (2104-2020)	$ 1,373,656	$ 195,426	
			International Crops Research Institute for the Semi-Arid Tropics	Improving postrainy sorghum varieties to meet the growing grain and fodder demand in India (ACIAR project led by ICRISAT) (2013-17)	$ 54,480	$ 13,620	
				TOTAL	**$12,829,217**	**$3,176,544**	

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Winter Cereal Crop Improvement

87.

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding				Alignment to Qld's Ag Strategy and/or RD&E Plan
K Chenu **J Christopher** **L Hickey** **$459,851**	**Winter Cereal Crop Improvement** QAAFI and its collaborators use cutting edge science in genetics, physiology and modelling to pursue novel adaptive traits and management systems to increase the productivity, profitability and potential growth of the $600 million Queensland winter cereal industries. Success of this program should result in a 2% annual increase in seasonally adjusted productivity along with improved disease resistance and product quality.	Key deliverables towards the objective in 2014-15 I. Development of markers and selection strategies for stay-green in wheat; at least 700 nested association mapping population lines progressed to F4 and field phenotyped for yield and stay-green as well as root phenotyped in the laboratory by July 2015. II. Identification of new sources of genetic resistance to key foliar diseases in wheat; at least 250 wheat landraces sourced from the Vavilov Institute (St Petersburg, Russia) phenotyped for disease resistance (three rust diseases and yellow spot) and crossing to transfer new genes into Australian wheat varieties initiated by July 2015. III. Development of markers and selection strategies for multiple disease resistances in barley; at least 700 nested association mapping population lines progressed to F4 by July 2015. IV. Frost situation analysis; Post doctoral fellows appointed at CSIRO, USQ and UQ and modelling of the effects of frost in			TOTAL APPROVED	2104/15	1. Resource Availability - New genotypes and management systems to support cereal growers 2. Productivity - Crop improvement will result in new varieties and mgmt systems with increased yield and resilience to biotic and abiotic stresses 3. Markets - N/A 4. Production costs - will be lowered through more effective crop protection strategies
			Grains Research & Development Corporation	StressMaster: A decision support tool to manage irrigation in real time in managed environments (2012-15)	$ 168,724	$ 50,000	
			Grains Research & Development Corporation	Frost Situation Analysis (2013-15)	$ 300,000	$ 150,000	
			Commonwealth Scientific and Industrial Research Organisation	Resistance to pathogens (2013-2014)	$ 20,000	$ 20,000	
			UQ Early Career Research Grant	Mining novel disease resistance genes in wheat landraces from the VIR (N I Vavilov Research Institute of Plant Industry) collection (2015-17)	$ 39,000	$ 39,000	
			Grains Research & Development Corporation	Maintaining a barley pre-breeding capacity in Queensland (2013-19)	$ 166,136	$ 45,974	
			Grains Research & Development Corporation	Delivery of wheat root traits that contribute to water limited yield stability (2013-18)	$1,539,335	$ 419,976	

18/03/2015

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Winter Cereal Crop Improvement

88.

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding				Alignment to Qld's Ag Strategy and/or RD&E Plan
		the major cropping regions undertaken by July 2015. V. Evaluating frost screening methods for winter cereals; field frost trials conducted using time of sowing and photoperiod extension screening methods with a common set of germplasm at a common site by July 2015. VI. Drought environmental characterisation of the GRDC-funded managed-environment trials by July 2015. VII. By July 2015, 3 publications submitted and 3 presentations providing evidence of an improved understanding of biotic and abiotic stresses in wheat and barley.	Grains Research & Development Corporation	Accelerating the utilisation and deployment of durable adult plant resistance to leaf rust in barley (2015-19)	$ 438,953	$ 92,101	
			Grains Research & Development Corporation	Raising water productivity: trait assessment for Australian rain fed wheat (2013-18) (CSIRO lead – Total Funding $1,500,000)	$ 193,052	$ 100,888	
			Grains Research & Development Corporation	Evaluating frost screening methods for winter cereals (2014)	$ 229,904	$ 229,904	
			Grains Research & Development Corporation	A Generic x Environment characterization of the risk for Late Maturity Alpha-amylase across the main wheat producing shires of Australia (2014-17)	$ 427,564	$ 140,648	
				TOTAL	**$3,522,668**	**$1,288,491**	

18/03/2015

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Legume Crop Improvement and management

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
RCN Rao **$198,038**	**Legume Crop Improvement and management** QAAFI and its collaborators use cutting edge science in agronomy and physiology to pursue enhanced productivity, profitability and potential growth of the ~$200 million Queensland grain legume industries. Success of this program should lead to a 2% annual increase in seasonally adjusted productivity and quality and an increase in share of pulses in the total Qld grain region by 6% by 2018.	Key deliverables towards the objective in 2014-15 I. The GxExM effects on yield and quality of commercially relevant chickpea and faba bean varieties assessed in 19 field trials and reported to industry. II. Data on effects of row spacing and plant density on the N-contribution of pre-release chickpea and Fababean varieties collected. III. Data on effects of row spacing and plant density on water and radiation use efficiency of pre-release chickpea and fababean varieties collected. IV. At least 18 field trials to assess GxExM effects of mungbean, soybean and peanut planted in the summer 2014-15 V. By July 2015, at least 2 publications and 2 presentations providing evidence of an improved understanding of GxExM interactions for targeted pulse crops.	<table><tr><th></th><th></th><th>TOTAL APPROVED</th><th>2014/15</th></tr><tr><td>Grains Research & Development Corporation</td><td>Queensland pulse agronomy initiative to increase the reliability and yield of summer and winter pulses ((2013-18)</td><td>$ 2,261,992</td><td>$ 402,920</td></tr><tr><td></td><td>TOTAL</td><td>$2,261.992</td><td>$ 402,920</td></tr></table>	1. Resource Availability - new mgmt systems for new pulse genotypes enabling growers to utilise pulses more effectively in their cropping systems 2. Productivity - Crop improvement will result in new management systems with increased yield and profitability to support potential expansion of pulses growing regions 3. Markets - N/A 4. Production costs – Increased frequency of pulses will result in reduced farm inputs in synthetic chemicals

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Sub-tropical Fruit Tree Crop Improvement

90.

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
Bruce Topp **Liz Dann** **Craig Hardner** **Jim Hanan** **Neena Mitter (50%)** **Ralf Dietzgen (50%)** **$765,407**	**Sub-tropical Fruit Tree Crop Improvement** QAAFI and its collaborators use cutting edge science in genetics, rootstock evaluation, pathology, physiology and modelling to pursue productivity improvement and sustainable management practices for the $260 million Queensland avocado (farm gate) and $100 million macadamia industries. Success of this program should result in a 2% annual increase in seasonally adjusted productivity over the next 10 years.	Key deliverables towards the objective in 2014-15 I. Yield evaluations of macadamia rootstock trials finalised and new seedling progeny trees planted at trial site. II. 3 new peach selections distributed for small-scale industry evaluation and 500 seedlings planted in new progeny trial. III. Recommendations for improved and sustainable disease management strategies reported and communicated to avocado industry IV. Recommendations for improved and sustainable management of diseases reported and communicated to macadamia industry. V. Preliminary analysis and modelling of tree architecture data from mango, macadamia and avocado planting systems trials VI. By July 2015, at least 4 publications and 4 presentations providing evidence of an improved understanding of tree crop productivity and breeding efficiency, completion of at least one postgraduate student, and initiation of at least one.		1. Resource Availability - new genotypes available to selected horticultural industries 2. Productivity - Crop improvement will result in new varieties and mgmt systems with increased yield and resilience to biotic and abiotic stresses 3. Markets - N/A 4. Production costs - New production systems will result in significant reduction in production cost

		TOTAL APPROVED	2014/15
Horticulture Australia Limited	Macadamia breeding and conservation (2011-14)	$ 1,072,370	$ 395,912
Horticulture Australia Limited	Tropical Stonefruit Breeding and Evaluation (2014-19)	$ 450,062	$ 92,623
Horticulture Australia Limited	Disease management in macadamia industry (2012-17)	$ 825,000	$ 147,244
DAFF-Q	Improving yield and quality in avocado through disease management (2010-14)	$ 151,800	$ 30,000
UQ-CIEF	Sustainable horticultural practices: how effective are biological fertilisers? (2012-14)	$ 72,500	$ 7,181
Horticulture Australia Limited	Exploring alternatives for managing Phytophthora root rot in **avocado** (2014)	$ 53,400	$ 40,047
Horticulture Australia Limited	Avocado rootstock assessment and improvement (2015-17)	$ 16,783	$ 5,594
ARC Linkage Project	Strength in uniformity - Novel clonal technologies for a more productive avocado industry	$ 626,370	$ 209,875

18/03/2015

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Sub-tropical Fruit Tree Crop Improvement

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding				Alignment to Qld's Ag Strategy and/or RD&E Plan
				(2013-15)			
			Horticulture Australia Limited	Transforming sub-tropical/tropical tree crop productivity (2013-16)	$3,210,756	$ 366,802	
			Horticulture Australia Limited	RNA silencing based Phytophthora root rot resistant avocado rootstocks - Phase 2 (2013 – 2016)	$ 344,327	$ 140,000	
				TOTAL	**$6,823,368**	**$1,435,278**	

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Horticultural Crop Protection

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
Andre Drenth **Andrew Geering** **John Thomas** **Ralf Dietzgen (50%)** **Neena Mitter (50%)** **$557,925**	**Horticultural Crop Protection** QAAFI and its collaborators use cutting edge science in pathology, virology, and entomology to pursue effective disease management and resistance for the $500 million Queensland banana industry and other key horticultural industries. This program safeguards horticultural industries from losses, maintains product quality and market access. Success of this program should result in continuous production and market access of high quality horticultural products	Key deliverables towards the objective in 2014-15 I. Screening for resistance to Panama wilt against TR 4 implemented by July 2015 II. Diagnostic support provided to enable movement of germplasm and improve Biosecurity for horticultural industries. III. Trials established to study the black spot disease cycle in citrus by July 2015. IV. Plant defence responses to vegetable viruses evaluated to discover potential novel disease control targets V. By July 2015, 5 publications and 5 presentations providing evidence of an improved understanding of diseases of major horticultural crops, completion of at least one postgraduate student, and initiation of at least one		1. Resource Availability - N/A 2. Productivity - Crop protection research will result in mgmt systems and varieties with increased resilience to biotic stresses 3. Markets – Enable trade through ensuring market access for horticultural products and safeguard against exotic pathogens 4. Production costs will be lowered through more effective crop protection strategies

		TOTAL APPROVED	2104/15
Horticulture Australia Limited	Banana plant protection program (2011-16)	$6,089,514	$1,885,383
Horticulture Australia Limited	Joint Florida and Australia citrus black spot research initiative(2014-2018)	$ 427,831	$ 84,892
University of Florida	The leaf litter cycle of citrus black spot and improvements to current management practices (2013-16)	$ 256,401	$ 117,139
DAFF	Norfolk Island Surveys (2013-2014): Plant pathogens other than fungi (2013-14)	$ 104,499	$ 53,575
Australian Biological Resources Study	A molecular and morphological catalogue of Australian rust fungi (2012-15)	$ 148,500	$ 45,000
UQ Collaborative Industry Engagement Fund	Crop protection through topical application of clay-based nano-reservoir to deliver RNAi (2014-15)	$ 75,000	$ 62,445
	TOTAL	**$ 7,101,745**	**$ 2,248,434**

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Farming Systems

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
D Rodriguez **A Potgieter** **$392,559**	**Farming Systems** QAAFI and its collaborators use cutting edge science in agronomy, crop physiology, farming systems modelling, and commodity systems modelling to pursue design of farming systems better able to deal with production, climate and market risks. Success of this program will result in better informed decision making, enhanced productivity, and more resilient and sustainable production systems.	Key deliverables towards the objective in 2014-15 I. Results from on-farm green manure trials in Southern Queensland showing the potential of a range of legume crops and practices presented at two farmers' field days II. Livestock modelling capabilities integrated into APSIM whole farm modelling, applied to existing projects and submitted for publication III. Results from the evaluation of recently released maize hybrids grown at low plant populations in Queensland presented at two farmers' workshops and submitted for publication IV. At least 8 commodity forecasting reports to industry and government during the crop calendar. V. Crop area estimates for major field crops generated from remote sensing and delivered to industry. VI. By July 2015, at least two publications and two presentations on approaches to improve land productivity in Queensland cropping systems, completion of at least two postgraduate students, and initiation of at least one.		1. Resource Availability - N/A 2. Productivity - Develop sustainable intensification strategies for cropping farms in Queensland via experimentation and modelling 3. Markets – Support efficient grain handling and marketing through provision of timely commodity forecasts. 4. Production costs - N/A

		TOTAL APPROVED	2013/14
ACIAR (CIMMYT)	Sustainable intensification of maize-legume cropping systems for enhancing food security in eastern and southern Africa (2010-14) – SIMLESA I	$2,037,409	$ 100,000
ACIAR (CIMMYT)	SIMLESA II – proposed extension (2014-2018)	$3,124,000	$ 606,875
ACIAR (ILRI)	Integrating crop and livestock production for improved food security and livelihoods in rural Zimbabwe (2012-15)	$ 234,644	$ 78,215
Grains Research & Development Corporation	Tactical crop agronomy for sorghum and maize in the northern region (2014-17)	$ 534,870	$ 181,940
Grains Research & Development Corporation	High yielding cereal agronomy in the northern grains region. Yield gap analysis (2014-17)	$ 449.313	$ 196,748
	TOTAL	**$5,931,372**	**$ 1,163,778**

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Soil Health

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
M Bell **$216,597**	**Soil Health** QAAFI and its collaborators use cutting edge science in soil science and agronomy to pursue enhanced profitability and sustainability of Queensland's broad acre dryland farming systems. Success in this program should enable the realization of genetic and water-limited yield potential in grains and cotton cropping systems across northern Australia, while limiting offsite impacts of management inputs. Collectively this program will limit land degradation and maximize enterprise flexibility in response to economic and climatic signals.	Key deliverables towards the objective in 2014/15 I. Conduct of at least 10 field trials across the region quantifying response to P, K and S in summer and winter grain/grain legume crops. II. Conduct at least 3 cotton field trials to improve benchmarks for P, K and S fertiliser guidelines. III. Via detailed research, quantify and communicate the financial and economic benefits of next generation N fertilisers in terms of fertiliser N use and reduced gaseous losses. IV. Promote the economic benefits of nutrient management strategies to industry in at least 1 industry publication and GRDC Update V. By July 2015, at least 1 publication and 1 presentation, completion of 1 postgraduate student and initiation of another one.		1. Resource Availability - N/A 2. Productivity - Develop soil management strategies that facilitate the realization of genetic and agronomic advances in improved farm productivity, while ensuring sustainable use of the soil resource. 3. Markets - N/A 4. Production costs - Improving the efficiency of use of costly fertiliser inputs and rationalizing nutrient use across crop rotations will lower production costs and improve farm profitability.

		TOTAL APPROVED	2014/15
Grains Research & Development Corporation	Regional soil testing guidelines for the northern grains region (2012-17)	$ 1,396,561	$ 252,678
Grains Research & Development Corporation	Quantifying nitrous oxide losses and nitrogen use efficiency in grains cropping systems on clay soils with contrasting soil carbon status and land management (2012-15)	$ 540,516	$ 141,823
Federal DAFF	Quantifying nitrous oxide losses and nitrogen use efficiency in grains cropping systems on clay soils with contrasting soil carbon status and land management (2012-15)	$ 1,598,997	$ 762,197
Cotton Research & Development Corporation	Developing soil testing and fertilizer response guidelines to manage P, K and S fertility for irrigated and dryland cotton cropping systems (2012-15)	$ 1,152,531	$ 344,642
	TOTAL	**$4,688,605**	**$1,501,340**

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Plant Science – Weed Management

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's Ag Strategy and/or RD&E Plan
B Chauhan **$216,597**	**Weed Management** QAAFI and its collaborators use cutting edge science in weed control and weed ecology to pursue effective weed management in Queensland's broad acre dryland grain and cotton farming systems. Success of this program should result in increased profit via enhanced weed management.	Key deliverables towards the objective in 2014-15 I. At least 1 new weed management tactic identified for improved weed control. II. Better understanding of the ecology of 2 key weed species developed. III. A proven decision support model (Ryegrass Integrated Management) adapted for management of glyphosate-resistant weeds in cotton farming systems. IV. All advanced wheat and barley lines screened for tolerance to important herbicides used in the Northern Region V. By July 2015, at least 1 publication and 1 presentation providing evidence of new weed management tactics and improved understanding of weed ecology, and one post-graduate student initiated		1. Resource Availability - N/A 2. Productivity - New weed control tactics and strategies will be developed and defined, resulting in increased crop yield via improved weed management. 3. Markets - N/A 4. Production costs - Preserving current useful and affordable weed management via developing tactics to prevent and manage herbicide resistance.

		TOTAL APPROVED	2014/15
Cotton Research and Development Corporation	Staying ahead of weed evolution in changing cotton systems (2014-19)	$ 2,704,758	$ 308,011
Grains Research & Development Corporation	Improving IWM practices in the Northern Region (2011-16)	$2,475,000	$ 450,000
Grains Research & Development Corporation	Improved integrated weed management systems in transgenic farming landscapes (2011-2014)	$ 805,530	$ 64,075
Grains Research & Development Corporation	Herbicide tolerance screening of winter crops in NR (phase IV) (2009-15)	$ 454,992	$ 27,500
	TOTAL	**$6,440,280**	**$849,586**

ANNUAL ALLIANCE RESEARCH PLAN for 2014/15

Centre for Animal Science (CAS) Research Plan

QAAFI Centre Director – Prof Stephen Moore Signature: _____ 25/07/14

DAFF GM Animal Science – Peter Johnston Signature: _____ 25/7/14

Approved by the ARC: 18/8/2014

1. Justification for Government investment in the QAAFI Centre for Animal Sciences

The Government of Queensland has set a target of doubling the state's agricultural production by 2040. CAS aims to deliver a suite of research, development, education and training products to deliver this production target in Queensland's tropical and sub-tropical livestock industries.

As outlined in the state's DAFF agricultural RD&E plan, opportunities exist to increase the resource availability, productivity, market access and profitability of Queensland's livestock sector through increased uptake of known and new technologies. Segments of the industry have shown productivity growth and favourable rates of return despite variable climatic conditions and a high Australian dollar. Significant opportunities exist in working in new ways with the next generation of livestock business managers.

Queensland's livestock industries are major contributors to food production in Queensland. These industries also make a substantial contribution to the economy and viability of rural and regional Queensland. Cumulatively, livestock businesses account for $6.1 billion annually, with the beef industry accounting for 84% of the gross value of all the state's livestock industries and one third of the gross value of all Queensland's agricultural production. The beef industry alone provides nearly 52,000 jobs for Queenslanders. Intensive animal industries (dairy cattle, pigs, poultry and aquaculture) account for more than $1 billion in gross value of product while Commonwealth and State-managed fisheries account for $248 million. Livestock industries cover 85% of Queensland's land area and share terrestrial and aquatic resources with other industries.

The Queensland Government's 2012/13 investment of $2,457,978 in QAAFI's Centre for Animal Sciences is focused on increasing food production and developing a more productive and resilient Queensland economy. CAS will value add to the Governments investment by attracting $4,385,382 in external to UQ research funding. Utilisation of CAS/QAAFI research in partnership with Agri-Science Queensland will assist Queensland's livestock industries to:

- Double food production by 2040
- Increase the rate of productivity growth, profitability, environmental sustainability and social resilience of livestock production businesses;
- Increase the agricultural production for the state (GSP);
- Improve the quality, safety and marketability of livestock products for consumers and export markets; and,
- Improve livestock industries' strategic positioning and support industry to address labour and skills shortages.

Increased productivity in the agricultural sector delivers substantial benefits to consumers:

- Real cost of food decreases;
- Less seasonality in food availability;
- Giving year around availability to export markets
- Increased food quality; and,
- Improved food safety.

2. Medium Term Outlook for the Government Investment for the Research in CAS

Opportunities exist to increase the resource availability, productivity, market access and profitability of Queensland's livestock sector and this is supported by Queensland's agriculture strategy. Segments of the industry have shown productivity growth and favourable rates of return despite variable climatic conditions and a continuing high Australian dollar. Significant opportunities exist in working in new ways with the next generation of agribusiness managers. The industries are significant employers and major contributors to the economy and viability of a number of rural and regional areas throughout Queensland.

Livestock businesses face a number of changes and challenges to which they need to respond, including competition (domestic and international), declining terms-of-trade, rising energy costs, changing consumer demand and consumer expectations around animal welfare, a changing and variable climate, water restrictions, pests and diseases and minimising off-site impacts from livestock production systems. Livestock industries cover 85% of Queensland's land area and share terrestrial and aquatic resources with other industries.

The research community also faces significant challenges of declining investment in RD&E coupled with an increasing cost of R&D. This in turn may result in a disinvestment by research institutions making careers in the field unattractive and as the current researchers retire will result in turn to a reduction in research capacity.

Research organizations require greater collaboration among research partners, leveraging of additional funding, improved integration with other parts of DAFF and the increased use of e-communication. Community attention on the responsible use of natural resources and ethical treatment of animals in production systems will increase. Research will be increasingly required to underpin sound policy and legislation development in livestock industries and fisheries.

This environment provides an opportunity for the strategic advancement of CAS, with its extensive international and national linkages, that focuses on understanding the key impediments to increased livestock productivity. The Northern Beef Research Alliance between DAFF, CSIRO and QAAFI is an example of such linkages where research synergies can value add to the investment by funding partners.

The CAS partnership will facilitate the integration of relevant expertise from a diverse range of Institute, Faculty and School-associated research groups at UQ with food science innovation leaders from within DAFF to address these needs and opportunities.

CAS will focus its expertise in genetics, genomics, nutrition, health, animal welfare and food safety to deliver both scientific advances and specific outcomes beneficial to the Queensland and the global tropical livestock industries.

CAS currently has 2 focal research program areas of priority to DAFF

A. Tropical Livestock Health and Welfare

B. Tropical Livestock Productivity

Each area houses a number of innovative and focused research teams.

To deliver on these programs, CAS will draw upon leading-edge science approaches from disciplines based in biological, chemical, and physical sciences and mathematics, all linked to a more productive and resilient Queensland economy.

3. Criteria to be achieved from the Government investment for the Research in CAS

- Integration of relevant disciplinary capabilities across UQ and DAFF to develop collaborative major grant funding applications and research outcomes
- Leadership of strategic research and development from within the Centre with facilitation of extension, technology transfer and industry servicing activities via DAFF and other public and private industry development agencies
- Activities focussed on areas where there is a clear impact on food production in Queensland and provides a competitive advantage for Queensland
- Encouragement of innovation and attraction / retention of high quality staff
- Value adding to the government research dollar.

4. Risk Assessment for the Government investment for the Research in CAS

Livestock businesses face a number of changes and challenges to which they need to respond, including competition (domestic and international), declining terms-of-trade, rising energy costs, changing consumer demand and consumer expectations around animal welfare, a changing and variable climate, water restrictions, pests and diseases and minimising off-site impacts from livestock production systems. Livestock industries cover 85% of Queensland's land area and share terrestrial and aquatic resources with other industries.

It will remain important to ensure that CAS has an R&D portfolio that reflects the priorities of government and other stakeholders, for example the interface of production and health related R&D. A misalignment of CAS research funding opportunities with QLD government research priorities may

result in researchers pursuing funds in areas that may not optimally address the local issues. This needs to be monitored to ensure support is directed towards government priorities to ensure the State's investment returns value for money.

There needs to be a clear linkage developed between CAS and Future Beef and other extension networks to ensure relevant R&D is communicated to the industry in a fashion that is clearly understood by them. This will be addressed through early involvement of Future Beef staff in project design and implementation.

A limitation to the livestock research area is the amount of funding available from Rural Development Corporation sources. CAS will need to continue to be creative and find alternative sources of funding.

5. Research Objectives, Outcomes, outputs and associated projects

General objectives, outputs and outcomes are listed below for the two focal research programs in CAS. Identification of current projects is attached.

A. Tropical Livestock Health and Welfare

Objective – To improve tropical livestock health and welfare with concomitant increase in productivity and market access.

Outputs-

1. Development of alternatives to traditional husbandry procedures to enhance animal welfare

   - Breeding strategies to accelerate dissemination of hornless beef genetics
   - Non-surgical alternatives to management of fertility
   - Novel methods for delivery of biological and pharmaceutical treatments to enhance animal health and welfare

2. Disease diagnosis and health management in the tropics

   - Epidemiology, diagnosis and sustainable control of endemic and exotic diseases and pests in intensively and extensively managed livestock
   - Integrated pest management systems to improve animal health, welfare and productivity
   - Supporting exotic pest and disease preparedness

3. Management of zoonotic diseases and toxins in livestock populations and products for improved food safety.
   - Detection and management of environmental toxins and their effect on human and animal health, product acceptability and food safety
   - Detection and management of zoonotic diseases and their effect on human and animal health, product acceptability and food safety

Outcomes –

- A decrease in mortality and morbidity by effective control and treatments for pests and disease.
- Improved industry profitability.
- A reduction in pain and suffering through identifying ways to minimize stress, application of genetics to remove undesirable traits and improved management practices.
- Reduction in use of pesticides with concomitant withholding periods
- Safer environment and livestock products
- Improved market access and improved industry public perception.
- Improved biosecurity for Qld

B. Tropical Livestock Productivity

Objective – To improve on-farm livestock productivity and profitability in the tropics

Outputs –

1. Increased reproductive efficiency and performance of tropically adapted livestock
   - Identification and demonstration of relevant existing and emerging technologies
   - Genetics and genomics technologies suitable for use in northern (extensive) beef cattle improvement.
   - Identification of genetic and nutritional factors leading to reduction of losses from mating to weaning
   - Identification of genetic and nutritional factors leading to an increase in cow survival and nutrition for reproductive development
   - Identification of genetic and nutritional factors leading to reduction of post-partum anoestrous
   - Identification of genetic and nutritional factors leading to an increase in conception rates from artificial breeding to enhance herd genetic value
   - Improvement of management options of the breeder herd

2. Improved sustainable growth pathways through optimised nutritional inputs
   - Options for the acceleration of growth pathways for profitable and sustainable lifetime productivity
   - Development of improved tools for predicting and modifying growth
   - New and improved supplements and supplementation strategies relevant to the tropics
   - Improved uses of agricultural by-products
   - Ways to minimise environmental impacts, e.g., greenhouse gas emissions reduced, optimized grazing strategies
   - Identification and demonstration of new technologies for livestock management and production
   - Optimised strategies for utilisation of improved pastures and fodder crops
   - Development of rumen intervention strategies for optimum ruminant growth
   - Improved management options to optimise growth in northern environments.
   - A better understanding of how mineral nutrition, particularly phosphorus nutrition of cattle impacts animal performance.

Outcomes –

- Increased herd weaning rates and therefore increased productivity and profitability
- Sustainable cost effective and safe growth pathways for livestock
- Increased on farm productivity and profitability through implementation of systems approaches of management
- Improved access to new markets through improved product quality.

NOTE: Project/Deliverables are listed on attached spreadsheet

QAAFI Annual Research Plans – Deliverables for 2014/15
Centre for Animal Science – Tropical Livestock Productivity

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding					Alignment to Qld's agriculture strategy and/or RD&E Plan
Ala Lew Tabor Tim Mahoney Peter James 30% Geoff Fordyce Carol Petherick Mary Fletcher (75%) $944,066	**Tropical Livestock Health and Welfare** **Extensive Livestock Industry (Beef and Sheep)** QAAFI and its collaborators will use cutting edge science to improve the health and welfare of cattle and sheep to improve productivity, food safety and maintain national and international market access.	**Improved Health and Disease Management** Proof of concept established for activity of new insecticidal compounds against buffalo fly Prototype spray and bait formulations of mycopesticides developed and tested New family of rationally designed pesticides for control of sheep lice and blowflies Evaluation of 10 novel peptides in 2 cattle tick challenge trials for the identification of new cattle tick vaccine antigens. A new approach for the molecular genotyping of tick fever pathogens developed to improve the monitoring of tick fever vaccine breakdowns A prototype nanovaccine formulation for improved control of one cattle disease. A best-practice manual produced for the improved						Extensive Livestock (Beef and Sheep) 1. Resource Availability N/A 2. Productivity Reducing the impact of pest and disease through epidemiology and the development of diagnostic and integrated systems for the control of endemic and exotic diseases and pests in intensive and extensive beef production systems. 3. Markets Supporting exotic pest and disease preparedness and market access Developing technologies to support improved welfare and husbandry practices. Developing applications to detect and manage zoonotic diseases and toxins in livestock populations and products for improved food safety 4. Production costs Reduced production costs due to reduction in morbidity and mortality losses.

Grantor	Title	Timeframe	Total project	FY14-15
ACIAR	Enhancing smallholder cattle production in East Timor	2012-2015	$1,610,409	$480,993
Intervet Australia Pty Ltd	New compounds for Buffalo Fly control	2013-2014	$19,762	$17,965
MLA	Myco-insecticides for nuisance fly control in cattle feedlots	2012-2016	$519,076	$117,375
CSIRO	Ecdysome agonists for the control of sheep parasites	2013-2014	$19,250	$8,575
UQ Start-up Grant	MLA: Novel Anti-Cattle tick antigen	2014-2016	$383,279	$143,270
QLD Govt	TFC – Tick Fever Genotyping	2013-2014	$36,000	$36,000
QLD Govt	New Vaccines for Improved Animal Health	2012-2016	$1,910,000	$636,667
MLA	Live viral Vaccines for bovine respiratory disease: BVDV efficacy	2012-2015	$261,913	$41,856
MLA	Epidemiology and management of bovine respiratory disease in feedlot cattle (Meat and Livestock Australia project novated from DEEDI)	2010-2014	$1,886,473	$247,500
Total			**$6,646,162**	**$1,730,201**

QAAFI Annual Research Plans – Deliverables for 2014/15
Centre for Animal Science – Tropical Livestock Productivity

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to Qld's agriculture strategy and/or RD&E Plan
		management of bovine respiratory disease (BRD) in cattle feedlots leading to reduction in cost of production		

QAAFI Annual Research Plans – Deliverables for 2014/15

Centre for Animal Science – Tropical Livestock Health and Welfare (intensive livestock)

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding					Alignment to Qld's agriculture strategy and/or RD&E Plan
Patrick Blackall **Connie Turni** **Jess Morgan** $580,846	**Tropical Livestock Health and Welfare** **Intensive Livestock Industry (Pigs and Chicken)** QAAFI and its collaborators will use cutting edge science to improve the health and welfare of pigs and chickens to improve productivity and maintain national and international market access.	Improved Diagnostics Improved Health Management Establishing the causes of pleurisy in pigs at slaughter to reduce the cost of production, improve animal welfare and allow implementation of sustainable treatment options. Initial proof of concept of an alternative live attenuated vaccine against A pleuropneumoniae to reduce cost of production, improve animal welfare and avoid the use of antibiotics by switching to a sustainable prevention/control program based on vaccination. Improved, targeted antimicrobial treatment programs for porcine respiratory diseases as a	Grantor	Title	Timeframe	Total project	FY14-15	Intensive Livestock 1. Resource Availability N/A 2. Productivity Undertaking epidemiology and development of diagnostic and vaccine applications for control of endemic and exotic diseases and pests in poultry and pork production systems. 3. Markets N/A 4. Production costs Reduce production costs through improved health and welfare
			CRC for High Integrity Australian Pork	Antibiotic sensitivity for Haemophilus parasuis plus Actinobacillus pleuropneumoniae and other respiratory pathogens	2012-2014	$44,000	$17,165	
			CRC for High Integrity Australian Pork	Establishing the underlying causes of pleurisy to develop effective prevention and treatment measures	2014-2015	$153,606	$153,606	
			CRC for High Integrity Australian Pork	Live attenuated Actinobacillus pleuropneumoniae vaccines	2014-2015	$150,000	$100,000	
			ACIAR	Improving the production and competitiveness of Australian and Philippines pig production through better health and disease control	2014-2017	$1,728,876	$677,523	
			Total			**$2,076,482**	**$948,294**	

QAAFI Annual Research Plans – Deliverables for 2014/15 Centre for Animal Science – Tropical Livestock Health and Welfare (intensive livestock)				
DAFF $ Investment	Objective	Deliverables/Outputs	Additional outputs and leverage to funding	Alignment to Qld's agriculture strategy and/or RD&E Plan
		result of an understanding of the genetic basis of antimicrobial resistance in key porcine respiratory pathogens.		

QAAFI Annual Research Plans – Deliverables for 2014/15
Centre for Animal Science – Tropical Livestock Productivity

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding					Alignment to Qld's agriculture strategy and/or RD&E Plan
			Grantor	Title	Timeframe	Total project	FY14-15	
Brian Burns **Stu McLennan** **Athol Klieve** **Rob Dixon** **Geoffrey Fordyce (70%)** **Mary Fletcher (25%)** $952,989	**Tropical Livestock Productivity** QAAFI and its collaborators use cutting edge technology to improve the breeding and management of Queensland's extensive cattle herds to boost productivity across the industry and improve product quality to gain wider market access.	**Improved Nutrition** Improved systems to optimize cattle for growth and reproduction **Improved Reproduction** A new flow cytometric assay for sperm protamine deficiency evaluation developed and the correlation between sperm protamine deficiency and sperm chromatin integrity established leading to improved bull assessment of performance. **Better Gene Marker Adoption in Northern Herds** An economic model for the incorporation of gene marker technology on consumer eating quality of beef balancing consumer satisfaction with cost of implementation. Better integration of	UNE	Accelerated genetic improvement of reproduction - Subagreement (MLA grant administered by UNE)	2014-2019	$167,750	$65,000	1. Resource Availability N/A 2. Productivity Improving the reproductive performance of cattle through improved genetics, genetic tools, nutrition, and management. Improving sustainable growth pathways through optimised nutritional inputs 3. Markets Improving market access for northern beef products through higher quality. 4. Production costs Reduced production costs through higher reproductive efficiency and lower calf mortality.
			QLD Govt	Transformational genetic and breeding strategies to create a sustained and globally competitive Queensland tropical beef herd	2012-2015	$1,650,000	$520,956	
			Qld Govt	Queensland International Fellowship: Increasing reliability of NIRS (near infrared reflectance spectroscopy) to improve management of cattle nutrition and rangeland vegetation for productivity and sustainability	2012-2014	$27,500	$8,000	
			MLA	Improving prediction of phosphorus intake of cattle grazing tropical pastures	2012-2014	$88,000	$20,000	
			MLA	Improved management of cattle phosphorus status through applied physiology	2012-2017	$1,540,000	$571,000	
			Australian Agricultural Co Ltd	Development of herd specific genetic evaluation system for AAco Wagyu	2013-2014	$102,817	$43,470	
			MLA	Understanding the relationship between *Bos indicus* content and consumer eating quality using	2014-2014	$58,447	$58,447	

QAAFI Annual Research Plans – Deliverables for 2014/15
Centre for Animal Science – Tropical Livestock Productivity

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding					Alignment to Qld's agriculture strategy and/or RD&E Plan
		genotypic data from Brahman and admixed tropical composites to deliver better genetic estimates and increase rates of genetic improvement Improved methods for within herd genetic evaluation to deliver better genetic estimates and increase rates of genetic improvement		genetic markers				
			DAFF	Nick Corbet's salary	2014-2015	$30,000	$30,000	
			DAFF	Matt Kelly's salary	2014-2016	$50,000	$25,000	
			Total			$3,714,514	$1,341,873	

ANNUAL ALLIANCE RESEARCH PLAN for 2014/15

Centre for Nutrition and Food Sciences (CNAFS) Research Plan

QAAFI Centre Director – Mike Gidley M. Gidley

DAFF General Manager – Garry Fullelove Mackenzie

Approved by the ARC: 18/1/2014

1. Justification for Government investment in the QAAFI Centre for Nutrition and Food Sciences

The Government of Queensland has set a target of doubling the state's agricultural production by 2040. To be economically viable, this target will require the development and maintenance of high value markets and products at appropriate price-points that take advantage of the increased agricultural raw materials. The Centre for Nutrition and Food Sciences (CNAFS) will contribute to the creation of high value products through R&D that targets (a) increasing the demand for, and value of, harvested product, (b) identifying new market and post-harvest processing opportunities for Queensland agricultural products, and (c) improving consumer demand through enhanced quality and value of agriculture-derived food products in both domestic and export markets.

As well as making a substantial contribution to Queensland's economy through primary production, the food processing industry (post farm gate) is one of Queensland's largest manufacturing sectors, employing more than 40,000 workers producing annual revenue of $13.9 billion with $4.2 billion in exports. Production capabilities range from fresh fruit and vegetables, seafood, grains, sugar and meat to value-added foods including fresh ready-to-use horticultural products, processed foods and food ingredients. The industry is spread across 1030 food processing businesses in Queensland of which 95% are Small (employ <20) or Medium (employ 20-200) sized companies.

The CNAFS program particularly focuses on delivering products benefiting Queensland's tropical and sub-tropical horticultural, cropping and seafood industries. Utilisation of CNAFS/QAAFI research in partnership with Agri-Science Qld will assist these industries to:

- Increase the demand for, and value of, their harvested product either through improved varietal attributes and/or post-harvest processing and packaging.
- Produce new value added products that improves competitive position in target markets or opens up new market opportunities.
- Increase their skills and capacity to engage in food product innovation.

Achieving these outcomes will increase the value and sustainability of Queensland's food industry as well as boost employment opportunities particularly in food processing SMEs, a significant proportion of which are located in regional areas. Additionally, assisting industry to develop more nutritious, tasty and convenient fruit and vegetable products will help to increase consumption contributing to improving the health of Queenslanders.

CNAFS will contribute leading-edge science approaches from disciplines based in biological, chemical, and physical sciences and engineering, all linked to economic development targets for Queensland. This will add a new dimension to technical approaches for adding value to primary agricultural products as well as attracting students and researchers to the disciplines of nutrition and food sciences for the future benefit of the industry.

2. Medium Term Outlook for the Government investment for the Research in CNAFS

The major drivers for food innovation are to address the linkages between quality, health and convenience. Sustainability, food production ethics and food provenance are also increasingly seen as important by consumers. In addition, governments are recognising the importance of a healthy diet for minimising health care costs.

Marketing trends are therefore featuring health attributes, 'natural' origins, and sustainable/ethical production as selling points, in addition to eating quality and convenience. Commercial success is

increasingly driven by delivering natural foods with 'as fresh' properties in stable and convenient formats. This is in contrast to the traditional model of food processing that involves extensive refining or heat treatment of agricultural produce and energy-intensive assembly into foods.

The focus on foods obtained more directly from agriculture provides a point of differentiation for CNAFS within the nutrition and food sciences in Australia. It is also consistent with the current nature of the food processing industry in Queensland which is mostly focused on value addition to local produce.

This environment provides an opportunity for the strategic advancement of CNAFS, with its extensive international and national linkages, that focuses on understanding the molecular and materials basis for food properties, and applies the knowledge gained to drive innovations in quality, health, safety and processing technologies in the area of 'naturally functional foods'. Inherent to subsequent commercial success is an understanding of the needs and attitudes of consumers, which in turn drives a 'fork to farm' approach to food chain innovation.

The CNAFS partnership will facilitate the integration of relevant expertise from a diverse range of Institute, Faculty and School-associated research groups at UQ with food science innovation leaders from within DAFF to address these needs and opportunities.

CNAFS has 3 focal research program areas, each housing a number of innovative and focused research teams:

1. Molecular basis for food quality

Focus areas:

To understand the molecular basis and consumer perception of quality parameters (aroma, taste, colour and texture) in natural foods such as fruits, vegetables, grains and seafood in order to develop premium products

To determine the molecular and microbial mechanisms of quality changes during processing, storage and distribution of natural foods in order to develop technologies for improved quality and convenience, shelf life preservation and safety

2. Food bio-materials and processing

Focus areas:

To understand the structural properties of natural food components in order to optimise raw materials and process combinations to enhance desired food properties

To develop new extraction and processing technologies for crops to deliver products with enhanced functionality

To develop new food, biomaterial and packaging technologies to enhance the sustainable production, preservation and shelf life of food crops

3. Health and nutrition properties

Focus areas:

To enhance health and nutrition properties of crops through (a) biofortification using conventional breeding, and (b) varietal selection based on nutritional bioactive content

To understand the biochemical and cellular mechanisms related to the digestion and uptake of food nutrients, to predict bioavailability and enhance desired attributes

To identify molecular and cellular modes of action of bioactive components from Queensland crops for marketing information and to identify breeding targets

These targeted programs will deliver strong economic growth in a medium term outlook by providing technologies and solutions to industry. CNAFS research will interface with plant production and crop quality research in CPS and animal production and meat quality research in CAS to deliver co-ordinated and integrated effort across QAAFI. The CNAFS partnership will facilitate the integration of relevant expertise from a diverse range of Institute, Faculty and School-associated research groups at UQ with nutrition and food science innovation leaders from within DAFF to address these needs and opportunities.

3. Criteria to be achieved from the Government investment for the Research in CNAFS

- Integration of relevant disciplinary capabilities across UQ and DAFF to deliver collaborative research outcomes that value add to Government investment
- Leadership of strategic research and development from within the Centre with facilitation of association between discovery and development science via close engagement with DAFF, other relevant agencies, industry, and community of practice.
- Activities focussed on areas where there is competitive advantage for Queensland and Queensland industry impact in alignment with the National RD&E Strategies for horticulture, grains and food.
- Encouragement of innovation and attraction / retention of high quality staff using appropriate incentives

4. Risk Assessment for the Government investment for the Research in CNAFS

The risk of a reduced technical capacity to innovate in the sector is high, in part because the attractiveness of the traditional food science disciplines to talented school leavers has steadily diminished over the past decade, and there has been a lack of renewal of expertise within Government. Thus one role of the Centre will be to encourage and facilitate engagement of postgraduate and postdoctoral scientists to work with senior scientists in CNAFS. This mentoring will be one avenue to support development of technical expertise needed for the future and minimize the impacts of generational change. Another role for the Centre will be to encourage and facilitate an increase in the quantity and quality of food science students available to enter the food processing sector on graduation.

5. Research Objectives, Outcomes, outputs and associated projects.

Over-arching objectives cutting across the three focal research program areas in CNAFS are given below. Specific details on 2014-15 objectives and deliverables are attached –

I. Increased demand for and value of harvested product

Objective – Defining and quantifying market appropriate attributes, and devising measurement methodologies for efficient selection of fit for purpose varieties.

Scope includes all grains and horticulture crops, and targets include selection for enhanced properties as well as methods for improving efficiency of selection in breeding programs.

II. New market opportunities and processes

Objective – Identify, develop and deliver foods and ingredients that create market opportunities applicable to increasing value for Queensland.

Scope includes:

(a) developing new food and ingredient opportunities for Queensland crops through understanding consumer drivers and market opportunities, and

(b) value addition through identification of mild processing and preservation treatments which maintain 'as fresh' sensory properties and/or enhance nutrition attributes.

III. Improved consumer demand through enhanced quality.

Objective – Enhancing demand for Queensland produce through creating and validating products with superior nutritional and/or sensory characteristics.

Scope includes:

(a) nutritional biofortification of crops,

(b) validation of nutritional properties of Queensland produce,

(c) identification of regional and combination flavour opportunities from sensory and consumer science, and

(d) preservation and packaging opportunities for delivering fresh, safe products to consumers.

QAAFI Annual Research Plans – Deliverables to be delivered in 2014/15
Centre for Nutrition and Food Sciences

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to the Qld Agriculture Strategy and/or RD&E Plan
Fox 100% Netzel 100% Gidley 15% $342,577	**Increased demand for and value of harvested product** Defining and quantifying market appropriate attributes, and devising measurement methodologies for efficient selection of fit for purpose varieties. Scope includes all grains and horticulture crops, and targets include selection for enhanced properties as well as methods for improving efficiency of selection in breeding programs.	3 key deliverables towards the objective in 2014-15 1. Identification by June 2015 of one new quality characteristic with the potential to increase crop demand for each of barley and sorghum. 2. Phytochemical screening to identify increased food value opportunities for strawberries and sorghum by June 2015. 3. Four Queensland rice species characterised sufficiently to establish potential industry suitability in domestic and export markets by June 2015.		1. Resource Availability N/A 2. Productivity Increasing the demand for and value of harvested product 3. Markets N/A 4. Production costs N/A

Grantor	Title	Year	Total Project	FY14-15
W Aus Agric Auth	Barley Grain Defects	2012-15	$330,000	$126,000
UQ Coll and Ind Eng Fund	Foam proteins from malt	2014-15	$79,930	$66,155
ARC	Centre of Excellence in Plant Cell Walls	2011-17	15% of funding $1,007,216	$143,888
ARC Discovery	Glucose polymers	2013-15	$390,000	$130,000
Total			$1,807,146	$466,043

QAAFI Annual Research Plans – Deliverables to be delivered in 2014/15

Centre for Nutrition and Food Sciences

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to the Qld Agriculture Strategy and/or RD&E Plan
Sultanbawa 60% Smyth 50% Gidley 20% $284,018	**New market opportunities and processes** Identify, develop and deliver foods and ingredients that create market opportunities applicable to increasing value for Queensland. Scope includes (1) developing new food and ingredient opportunities for Queensland crops through understanding consumer drivers and market opportunities, and (2) value addition through identification of mild processing and preservation treatments which maintain 'as fresh' sensory properties and/or enhance nutrition attributes.	4 key deliverables towards the objective in 2014-15 1. Creating one new market opportunity for Kakadu plum by June 2015. 2. Identification of industry-applicable functional ingredients from both lemon myrtle and anise myrtle by June 2015. 3. Identification of sensory traits & consumer drivers to create competitive advantage for two Qld agri-products by June 2015 4. Facilitating new market opportunities through at least 5 activities involving transfer of technical knowledge to industry producers, chefs, consumers, and trainees by June 2015	<table><tr><th>Grantor</th><th>Title</th><th>Year</th><th>Total project</th><th>FY 14-15</th></tr><tr><td>RIRDC</td><td>Monitoring quality and bioactivity of kakadu plum in the Northern Territory</td><td>2014-16</td><td>$110,000</td><td>$75,000</td></tr><tr><td>RIRDC</td><td>Lemon and anise myrtle: unique functional ingredients in cross industry applications</td><td>2014-16</td><td>$143,281</td><td>$71,640</td></tr><tr><td>ARC</td><td>CoE in Plant Cell Walls</td><td>2011-18</td><td>20% of funding $1,342,957</td><td>$191,851</td></tr><tr><td>ARC-Training Hub – Agents of Change</td><td>Consumer insights, fore-sighting and market intelligence to increase success of Australian Red meat products into Asia</td><td>2014-17</td><td>$360,000</td><td>$60,000</td></tr><tr><td>AusAid</td><td>Effects of irradiation on mango quality</td><td>2012-15</td><td>$120,000</td><td>$40,000</td></tr><tr><td>ARC Linkage</td><td>Understanding coffee quality</td><td>2013-16</td><td>$ 632,840</td><td>$208,856</td></tr><tr><td>Total</td><td></td><td></td><td>$2,709,078</td><td>$647,347</td></tr></table>	1. Resource Availability N/A 2. Productivity N/A 3. Markets Identifying new market opportunities and the processes to refine raw produce to a stage suitable for new and established uses and markets. 4. Production costs N/A

18/03/2015

QAAFI Annual Research Plans – Deliverables to be delivered in 2014/15

Centre for Nutrition and Food Sciences

DAFF $ Investment	Objective	Deliverables/ Outputs	Additional outputs and leverage to funding	Alignment to the Qld Agriculture Strategy and/or RD&E Plan
O'Hare 100% Netzel 50% Smyth 50% Sultanbawa 40% Gidley 15% $516,576	**Improved consumer demand through enhanced quality.** Enhancing demand for Queensland produce through creating and validating products with superior nutritional and/or sensory characteristics. Scope includes (a) nutritional biofortification of crops, (b) validation of nutritional properties of Queensland produce,(c) identification of regional and combination flavour opportunities from sensory and consumer science, and (d) preservation and packaging opportunities for delivering fresh, safe products to consumers.	5 key deliverables towards the objective in 2014-15 1. Four elite high-zeaxanthin sweet-corn hybrids evaluated for consumer acceptance by December 2014. 2. Six industry presentations and publications to promote consumer demand in support of Qld agri-food industries by June 2015. 3 New tools and data used to identify distinctive nutritional, flavour and sensory properties of two Qld agri-food products for industry application by June 2015. 4. Application of native plant extracts to improve the quality and safety of sweet corn demonstrated to an industry collaborator by June 2015. 5. Complete the first of three steps to produce high-lycopene tomato parent lines in an elite gourmet background by June 2015.		1. Resource Availability N/A 2. Productivity N/A 3. Markets Improved food quality: delivering fresh, safe, and nutritious products to consumers 4. Production costs N/A

Grantor	Title	Year	Total Project	FY 14-15
RIRDC	Feasibility and opportunities for Peruvian purple corn in Australia	2014-15	$27,500	$27,500
RIRDC	Native plant extracts for extended shelf life in corn	2014-15	$110,000	$110,000
Horticulture Australia Limited	Optimisation of high-lycopene tomatoes for tropical conditions	2014-16	$483,986	$241,993
ARC	Centre of Excellence in Plant Cell Walls	2011-18	15% of funding $1,007,216	$143,888
ARC-Training Hub – Agents of Change	Applications of grains and derived extracts in consumer products	2014-17	$360,000	$60,000
CRC for High Integrity Australian Pork	Use of plant derived compounds to condition piglet intake at weaning and reduce post-weaning use of therapeutics	2012-15	$285,376	$87,795
Total			$2,274,078	$671,176

114.

Reporting Document

Agricultural R&D – Six monthly Report

Queensland Alliance for Agriculture and Food Innovation

Centre - Plant Science

Performance Highlights for July to December 2014
Objective - Improve industry performance through innovation

During this period the Centre for Plant Science in QAAFI has progressed significantly on deliverables detailed in the 2014/15 Annual Research Plan. The narratives below (grouped by alignment to the Queensland Agriculture Strategy (Pathways 1-4)) set out the overall progress of the Centre, identifying key achievements and key challenges. In addition to the information provided in the narratives, there has been on-going training of post-graduate students (including a number of completions), publications in scientific journals (including a number of high profile papers), presentations to conferences and industry fora across the spectrum of activity, and development of advanced tools that underpin the R&D, such as the APSIM modelling platform, and various data bases and analysis tools.

The quality of the R&D activities undertaken in the centre is further evidenced by invitations to staff to present their research at local, national, and international industry and scientific meetings. Specific invitations have also been received for direct negotiation of research projects.

Pathway 1: Resource availability - securing and increasing resource availability
Use soil, water, plant and animal science to ensure ongoing resource availability Provide modern, efficient research infrastructure to support all providers of agricultural RD&E
Research capacity and Infrastructure QAAFI will lead the UQ node of The Australian Research Council Centre of Excellence (CoE) in "Translational Photosynthesis" partnership with ANU ($22m over 7 years), which will look at the next generation of advances in crop productivity through manipulation of photosynthetic pathways in plants. The centre was officially opened at ANU in October 2014 by Senator Zed Seselja (for Education Minister Pyne). Professors Hammer and Jordan participated in a public forum after the official opening with Chief Scientist Professor Ian Chubb and other chief investigators of the centre. Staff recruitment for the specific projects to be undertaken at UQ on modelling the likely value of proposed manipulations at crop level and searching the natural variation in genetic regulation of photosynthesis in sorghum, is nearing completion, and a number of new staff (post-docs in quantitative genetics, crop physiology, modelling; technicians in programming, phenotyping technology, field experimentation) will take up positions early in 2015. Significant funds for purchase of capital equipment have been expended since June to purchase equipment needed (photosynthesis measurement; field phenotyping rig) for this research. The funds from the CoE project have been combined with a UQ Major Equipment and Infrastructure grant to support development and purchase of a high clearance rig fitted with advanced remote sensing and data capture electronics for in-field phenotyping of breeding trials. QAAFI scientists have continued to engage with senior DAFF management on infrastructure issues. DAFF's Director-General, Jack Noye, met with QAAFI and DAFF scientists at Hermitage Research Facility (HRF) in July 2014 to discuss the challenge of increasing crop production in dry environments. The need for new research infrastructure was discussed and $1.2M has recently

been allocated by DAFF to build new glasshouse/growth-room/office facilities at HRF

QAAFI's capacity to run and monitor on-farm and on-research station agronomic and crop eco-physiology trials was significantly increased with the appointment of Dr Ariel Ferrante in the farming systems team, purchase of a new Monosem precision planter, and proximal sensing platform for rapid on-farm data acquisition of crop reflectance data. The new precision planter is being used to run a large network of maize and sorghum agronomic experiments on farmers' fields in collaboration with seed companies and DAFFQ; the proximal sensing platform is being used to collect canopy reflectance data that will be later used to derive crop properties of interest from complex and large field trials; Dr Ariel Ferrante will investigate cereal yield determinants and production risk of improved germplasm in the Queensland cropping zone.

Pathway 2: Productivity - driving productivity growth across the supply chain

Establish Queensland as an international leader in subtropical and tropical agriculture by developing:
a five-year agriculture RD&E strategy focusing on beef, horticulture, sugar and broadacre crops
new knowledge, products, technologies and processes to lift productivity across the supply chain
Encourage the uptake of research and development to deliver benefits to all Queenslanders
Maximise RD&E impacts and investment through effective partnering arrangements

Our research in this area aims to improve productivity, quality, and production efficiency in key Queensland grain and horticultural crops and farming systems.

Sorghum

All Deliverables
The delivery to industry of improved germplasm lines from the sorghum pre-breeding program is critical to on-going yield advance and profitability for growers. Thirty one new germplasm lines have been licensed to commercial seed companies since July 2014. This achievement has been supported by advanced genotyping and genetic analysis, and associated on-going physiology and modelling studies on the key drought adaptation traits staygreen, root system architecture, and water use efficiency. Specific populations have been developed with the aim of discovering key genes for drought-adaptation in sorghum. Research conducted by QAAFI scientists resulted in the discovery of regions of the sorghum genome controlling tillering, grain size and rust resistance. In addition we discovered an association between the variation in carbon distribution in the plant and increased susceptibility to fungal pathogens. The latter finding will have an important bearing on selection of hybrid sorghum resistant to pathogens, which cause lodging that is one of the major production constraints of sorghum. QAAFI's research approach to drought adaptation in sorghum was also presented to two Queensland Ministers (Hon John McVeigh and Hon Andrew Cripps) at grain industry meetings in November 2014 at Kingaroy.

Significant advance and discovery has been made in relation to high temperature stress tolerance in sorghum. The research enhanced the understanding of mechanisms associated with high temperature effects on pollen viability and seed set, identified significant and useful genetic variation in sorghum parental lines, and facilitated adaptation of the APSIM sorghum model to simulate risks of incidence and likely consequences on yield in key production environments. These results will be communicated to advisers and growers in the upcoming Grains Research and Development Corporation (GRDC) updates (early 2015). Two scientific papers have already been published (Functional Plant Biol; Field Crops Res) and two more nearing submission. Discussions are underway to pursue funding of this work for mapping studies to underpin the nature of the genetic control. A postgraduate student involved in this research successfully completed her PhD degree and graduated in December 2014.

Further research on the genetic regulation of the root angle trait in sorghum has been initiated. Previous research indicated likely significant value to sorghum pre-breeding in Queensland as direct associations with yield were identified in breeding trials for entries carrying key regions controlling the root angle trait. The phenotyping system for sorghum roots developed in earlier QAAFI research will be adapted to high-throughput status as part of these projects, which have attracted a grant from the Bill and Melinda Gates Foundation (BMGF) to screen the Ethiopian sorghum

germplasm collection. The Program for Emerging Agricultural Research Leaders (PEARL) was launched in Seattle in November 2014 and the new project with Jimma University will be closely linked to the existing UQ/EIAR project funded by BMGF in Ethiopia.

Winter cereals

Deliverable 1 – Staygreen and drought adaptation in wheat
Possibilities for advanced drought adaptation in wheat, which would have major significance to the industry, are possible through development of staygreen and root traits to enhance drought adaptation. The wheat, Nested Association Mapping (NAM) population developed to incorporate adaptive stay-green and root traits into wheat was successfully field tested for the first time at Hermitage in 2014. The yield and stay-green trait data generated for over 700 NAM lines will be analysed and used to select a population of superior lines for multiple environment trials in Queensland during 2015. DNA from the population has been sent for genotyping using the DArTseq platform. It is currently being phenotyped for root traits in the glasshouse using the new, high throughput root phenotyping system that has been developed and validated by PhD candidate Cecile Richard.

A recent discovery on transpiration efficiency in wheat, which is known to have major consequences on yield in water-limited environments, will have implications for future crop improvement. A panel of wheat cultivars released at a range of dates between the 1960s and present was characterised for transpiration efficiency (TE) in the "Lpad" lysimeter system at UQ Gatton in 2014 revealing a small but significant trend towards increased TE in more recent cultivars. This indicates that increased yield in more recent cultivars may be at least partially due to unconscious selection for improved TE and suggests that active selection for TE may be advantageous for Australian wheat. Drs Chenu, Christopher, and Hickey have participated in international meetings co-ordinated by CIMMYT to discuss further development of this research via targeted international collaboration.

Deliverable 2 – Foliar diseases in wheat
Foliar diseases are a major impediment to productivity in wheat and a critical requirement for genetic regulation by industry. A wheat diversity panel comprising 300 landraces and old cultivars were evaluated for resistance to key foliar diseases in the field and glasshouse, including stripe rust, stem rust, leaf rust and yellow spot. DNA for the panel of lines has been extracted and sent for genotyping with DArTseq DNA markers. Selected genotypes displaying high levels of adult plant resistance to rust and yellow spot diseases are currently being crossed to several Australian wheat cultivars. New PhD candidates were appointed to work on wheat foliar disease resistance projects, including Adnan Riaz (leaf rust) and Eric Dinglasan (yellow spot).

Deliverable 3 – Foliar diseases in barley
Foliar diseases are a major impediment to productivity in barley and a critical requirement for genetic regulation by industry. The barley NAM population targeting multiple disease resistance is currently under development. Crossing and F1 generation was grown in the speed breeding system at St Lucia and F2 populations were grown in the field at Wellcamp this year. A total of 1,600 F2:F3 lines from 33 crosses have been progressed for line development in the speed breeding system over summer 2014.

A new PhD candidate, Hannah Robinson, was appointed to investigate the relationship between stress tolerance genes and grain quality in barley.

Deliverables 4,5 – Frost in wheat
Frost tolerance is anticipated to confer major advances in wheat yield, but its realisation has been problematic. Post doctoral researchers have been appointed and crop simulation modelling to evaluate the impact of frost occurrence on wheat in each of the major Australian cropping regions is well advanced.

Other points to note -
More than 120 people attended a joint QAAFI-DAFF-CSIRO winter cereals field day and workshop at Gatton on 1 Oct 2014. The day was divided into a number of themes: Wheat abiotic stress, yield potential, phenomics, and disease resistance. All the presentations were set in the field, and supported by activities or demonstrations. QAAFI Research Fellow, Dr Lee Hickey, jointly led the

organisation of the day.

GRDC has approved a new project that will use our agro climatic models and remote sensing techniques to characterise the risk of the grain quality defect, late maturity Alpha-amylase, in wheat crops across Australia. The research has the potential to assist breeding and help industry to save up to $22 million per annum in losses due to high Alpha-amylase grain. This project is to start early January 2015 and a post-doctoral fellow has been appointed to work with project leader Dr Potgieter.

Grain Legumes

Deliverables 1-4 – GxExM and agronomy in key grain legumes
Adapting key grain legumes for consistent use in Queensland grain farming systems has potential to generate significant sustainability and system resilience advantages, but is constrained by limited crop adaptation and profitability. In this research, two year multi-location trials have confirmed a yield advantage of up to 20% by reducing row spacing of chickpea from conventional 1m to 50cm in Southern Queensland (SQ). However, row spacing responses were not significant in some environments in Central Queensland (CQ). The lack of response to row spacing was found to be underpinned by sub soil constraints, mainly P and K deficiencies. Future trials in CQ will address this region specific issue by linking with GRDC subsoil constraints project.

For fababean, field trials have revealed a significant GXExM interaction for yield advance (up to 150% increase) on the Downs suggesting scope for significant yield benefits by optimising agronomy. Time of planting seems to play a key role with planting beyond 2nd week of May resulting in significant yield reduction. As observed in other legumes, reducing row spacing increased fababean yield significantly (up to 80%) particularly in early planted crops. Subsequent research will be focused on understanding the physiology that underpins the GxExM interaction.

Deliverable 5 – Presentations and publications
Key results have been communicated to industry at two GRDC grower and advisor updates and three meetings with pulse industry groups (AMA, PA, PCA and Soy Australia) during Oct/Sep 2014.

Two articles have been submitted for publication in Pulse Australia and PBA new letters.

Dr Rao Rachaputi was invited to present a paper on "Profitable grain legumes for tropical cropping systems" at the Northern Food Futures conference at Darwin in Oct 2014.

An invited book chapter by Rao Rachaputi on "The Peanut" has been completed and scheduled for publication in the Encyclopaedia of Food Grains 2015. A book chapter on "High Temperature and Water Stress on Groundnut" has been completed and accepted for publication in a book "Combined Stresses in Plants" published by Springer.

Mrs Nia Patriyawathi has commenced a Mphil study in Late July 2014. Nia's study will focus on understanding the genotypic variation in mungbean for tolerance to and recovery from heat stress.

Farming Systems

Deliverable 1 – green manuring
The practice of "green manuring" (i.e. the use of short season legume crops) has significant potential to enhance the N economy and sustainability of Queensland grain cropping systems. A network of on farm trials has been established across the Darling Downs to quantify the nitrogen contribution from short term green manuring legumes in Queensland's grain cereal dominant cropping systems. The project is funded by Federal DAFF in partnership with Conservation Farmers Incorporated the only Queensland farmers' group.

Deliverable 2 – Integrating livestock modelling in APSIM
The capacity to integrate livestock and cropping enterprises is a key feature of many Queensland farms. There is significant opportunity to explore opportunities and trade-offs associated with such systems at whole farm scale. A new collaboration with CSIRO was established to apply the recently developed whole farm model (APSFarm-LivSim). This model will research benefits and trade-offs

associated with alternative investments and management strategies in modern farm business decision making when faced with variable biophysical, climatic, economic, and environmental conditions.

Deliverable 3 – Crop agronomy
Tactical manipulation of agronomic management of field crops remains a key area for potential crop improvement. A collaboration with DPI-NSW, Conservation Farmers Inc., DAFFQ and seed companies i.e. Pacific Seeds, DuPont Pioneer and NUSEED, has been established to research Tactical Agronomy for Sorghum and Maize in the Northern Region. The project, funded by GRDC, started in July 2014. Even though the prevailing dry conditions have been restrictive, five on-farm trials have been established at Brookstead, Cecil Plains, Jimbour, Dalby, and Kingsthorpe in Queensland; and four on-research station trials have been established at Gatton and Warwick.

Another collaboration with DAFFQ is researching High Yielding Wheat and Sorghum Agronomy in the Northern Region. The project, funded by GRDC, will deliver information for farmers and consultants from the Northern Region on how to better match genotypes and management across the different environments in the Northern Region. The expected outcome is that farmers will be able to reduce yield gaps while managing the risks associated with the increased inputs needed to support higher yields. Three on-research station trials have been established at Gatton and Warwick during the 2014/15 winter and summer seasons.

A selection of maize hybrids that are currently available to the Queensland market were evaluated at ultra low populations. This research demonstrated that grain yields of 10 t/ha can be achieved with multi-cobbing hybrids grown at 22,000 plants per ha and therefore reduces production costs (i.e. lower seed costs which are the greatest production cost for maize). These results have attracted investment from CIMMYT and GRDC to further optimise crop management of these hybrids for grain production and develop better guidelines for maize farmers. QAAFI has established a collaboration with CIMMYT funded by the CGIAR Maize Research Program (http://maize.org) to research the role of prolific maize hybrids in dryland farming systems. The expected outcome from this new project is improved guidelines for maize farmers to better match crop management for the existing types of maize hybrids in the market across the different Queensland environments.

Deliverable 5 – presentations, publications
In collaboration with DAFFQ, QAAFI conducted a Grain Cereals Workshop and Field day for farmers and private consultants at Gatton on the 21st July 2014. The workshop was supported by the GRDC and ACIAR and succeeded in attracting 80 participants, with many consultants and farmers attending.

In collaboration with CSIRO and the Global Change Institute, QAAFI conducted the Pathways for the Sustainable Intensification of Agriculture in High and Low-income Countries Workshop, 3-5 November 2014. The workshop succeeded in attracting more than 50 participants between academics and practitioners. Key messages and outcomes from this workshop have been published in an article in The Conversation.

Other points to note –
In collaboration with SARDI, QAAFI is in direct negotiation with GRDC for a project titled Nitrogen and Water Interactions. This new project will combine (1) new data from current GRDC projects (DAS00147, UQ00074, and UQ00075), (2) new modelled data from APSIM, (3) seasonal climate forecasts from POAMA and frameworks for valuing forecasts from MCV00037.111 and (4) literature data. Expected outputs include an industry report with a focus on key messages for growers and advisors, articles for GROUNDCOVER and the Managing Climate Variability Newsletter, and a scientific paper for submission to Crop and Pasture Science.

Horticulture

Deliverable 1 – macadamia
There is significant opportunity for enhanced profitability in macadamia through increased yield by breeding. Elite selections with nut-in-shell yield increase of 39% have been identified. This is a substantial gain but it is based on data from single unreplicated seedling trees and will need to be

confirmed with replicated testing of the clonally propagated elites.

Bruce Topp and his team continue to advance breeding research. Forty two open-pollinated macadamia families have been planted at Maroochy Research Facility and a further 1,678 seedling progeny were also planted at Bundaberg Research Facility. The parents were identified using breeding values calculated from the first generation progeny. The families have been planted at high density (6 m x 1 m) at Maroochy Research Facility and will be evaluated over 5 rather than 8 years. The high heritability traits of kernel recovery and kernel size are being selected initially when there is a single tree of each genotype. Selection for the low heritability trait of nut-in-shell yield will occur later when there is replication.

Yield evaluations for the four macadamia rootstock trials at Baffle Creek, Bundaberg, Wollongbar and Newrybar have been completed. It was found that scion accounted for more of the variation in all the measured traits (yield, tree height and tree canopy width, total kernel recovery) than did rootstock. There was however some rootstocks that out-yielded the Australian commercial standard rootstock.

Deliverable 2 – peach
There is significant opportunity for enhanced profitability in peach through increased yield by breeding. Peach pollinations were completed in winter 2014 by Bruce Topp and over 3000 seeds harvested for a new progeny trial. Stefano Foschi, the peach breeder from the Plant Production Research Centre of Cesena, Italy assisted with our breeding from July to December 2014. In addition embryo culture was used on early ripening seed parents that had fruit development periods (FDPs) of less than 80 days. The embryo culture techniques were developed in the previous project SF07003 and allow development of immature in-ovulo embyros on nutrient agar using aseptic techniques. Over 1,000 embryos were cultured.

Six new selections were distributed to five growers for small-scale testing in winter 2014. Two trees of each selection plus the standard cultivar 'Tropic Beauty' were sent. The selections included a peach and a nectarine that ripen in October and have the freestone character. Low-chill cultivars are unique in possessing the freestone characteristic in fruit that are harvested in October. This may be an important marketing distinction in future years.

Deliverable 3 – avocado
Control of Phytophora root rot and postharvest diseases offers significant opportunity for productivity and profitability advances in avocado. Elizabeth Dann and her team have demonstrated the critical interactions between control agents and rootstock required for effective management of Phytophthora root rot. New chemistries for Phytophthora root rot and postharvest fruit diseases (anthracnose and stem end rot), have been evaluated, with likely progression to registration. Six conference/field day presentations have been made to communicate results.

Deliverable 4 – disease management in macadamia
Husk spot remains a significant disease of macadamia with a potential to generate major yield loss. Field trials in macadamia were established at Bundaberg to examine the effect of cultural practice and fungicide spray applications on husk spot incidence and severity. Removal of diseased immature fruit was an effective strategy. In addition, the efficacy of alternative fungicides was tested. Field trials are now underway in commercial orchards in the Northern Rivers and Bundaberg districts. Recent publications in industry magazine include: Soil health and tree decline. Australian Macadamia Society News Bulletin 2014 Vol. 42. Both Dr Andre Drenth and Femi Akinsanmi gave presentations at the nut symposium at the International Horticultural Congress. 21 August 2014, Brisbane.

Deliverable 5 – small trees high productivity initiative
An opportunity to transform sub-tropical tree crop productivity by a combination of dwarfing and system intensification has been identified. This is the second six-month period of the "Small tree-high productivity initiative" project collaboration between QAAFI, DAFF Qld and NSW DPI on transforming subtropical/tropical tree crop productivity, funded by HIA. Newly established avocado rootstock and planting systems trials along with existing mango and macadamia trials have provided material for the ongoing phenological genetic map studies.

Dr Inigo Auzmendi commenced as modelling post-doc in July 2014, and has developed a prototype flush model driven by photosynthesis and carbon allocation, which stimulated valuable discussion of hypothesised mechanisms in the different species on presentation at the Annual Program Review Meeting held in November 2014 in Bundaberg. Two PhD students have commenced, one in Mareeba (Anahita Mizani) and one in Bundaberg (Ben Toft) co-advised by DAFF staff. Both students have attended a two day modelling workshop presented by Dr Hanan at UQ.

Two IHC 2014 satellite meetings were organised to discuss potential collaboration with a number of IHC international attendees from France, USA, and India. Dr Hanan also presented a hands-on workshop on Functional Structural Plant Modelling at the IHC.

Two industry articles were published in the Australian Macadamia Society News Bulletin, (2014, 42: 74-77 and Talking Avocados, (Spring 2014 Issue: 24-27) and Dr Jim Hanan gave a presentation entitled "A Model of Macadamia with Application to Pruning in Orchards" at The International Horticultural Congress. 21 August 2014, Brisbane.

Other points to note -
The genetic structure of remnant wild macadamia populations, wild origins of Hawaiian cultivars and relationships among Hawaiian cultivars and selections introduced into Australia was determined by Honours student Ainnatul Ahmad Termizi, in collaboration with Prof Jacqui Batley (UQ) and Cathy Nock (SCU). This information was used to improve accuracy of prediction of genetic potential of individuals in progeny trials and guide further cross and germplasm introduction and management.

Dr Craig Hardner gave an invited presentation: "Domestication pathway of Hawaiian macadamia cultivars" Australian Native Plants Society (Australia), and also to the Hawaiian Macadamia Nut Producers Association Annual Meeting. He also gave a paper at the 29th International Horticultural Congress, Brisbane Convention Centre on the 18-22 August 2014.

Dr Craig Hardner has advanced activities to support the enabling of DNA marker technology in Horticultural fruit breeding programs via collaboration with the Department of Horticulture Washington State University. Projects will support the genotyping of 100 samples from the DAFFQ apple and strawberry germplasm for known fruit quality trait DNA tests and data analysis to improve accuracy of prediction of genetic potential of this germplasm in Australian and exotic environments, and identify sources of novel germplasm from off-shore collections that will improve efficiency of QDAFF genetic improvement programs.

Pathway 3: Markets - securing and increasing market access

Undertake research and development to help maintain and/or expand market access
Support industry to produce and supply products that meet or exceed market expectations

Our research in this area aims to enhance disease management and biosecurity of key Queensland horticultural crops and support commodity logistics and marketing in key grain crops.

Horticulture

Deliverable 1 – Banana
Major diseases significantly constrain the Australian banana industry. Disease resistance and management of spread are critical to industry survival. Screening for resistance to Panama wilt in bananas is now well underway with the first trial finalised and a second trial planted in 2014. In addition, over 400 tissue cultured banana plants to be tested in the NT have now been sent to Wageningen University, The Netherlands, for screening for resistance to Australian races. Screening material overseas will speed up the process as we can screen prior to commencing import and lengthy post entry quarantine screening and allow us to screen for a wider range of exotic pathogens.

The banana freckle response moved into a $26M four-phase response plan in October 2014, which aims to eradicate it on both Cavendish and non-Cavendish banana. Specialist technical advice has been provided to the Northern Territory Department of Primary Industry and Fisheries (NTDPIF), the Consultative Committee on Emergency Plant Pests (CCEPP) and Biosecurity Queensland (BQ,

DAFF) on behalf of the Australian Banana Growers Council (ABGC).

A new post entry quarantine facility is now operational at the EcoSciences Precinct for the importation and indexing of banana germplasm. Indexing of banana germplasm already in Australia and used for commercial purposes continued unabated and 221 banana samples were indexed using molecular methods for banana viruses over the period of June to November 2014.

Dr John Thomas convened a Symposium Workshop entitled "Banana streak viruses and their impact on the use of germplasm" for the MusaNet Conservation Thematic Group, Bioversity International as part of the ProMusa Symposium at the International Horticulture Congress, Brisbane, 18-22 August 2014. Dr Geering presented a seminar as part of this workshop. Recommendations from this workshop have provided a strategy for the release and distribution of significant stocks of germplasm currently held in quarantine due to a moratorium on their use. The BSV research also involved a student, Nur Nabihah Mahfuz who achieved first class honours on identification of linear epitopes on the banana streak virus coat protein.

Dr Thomas also contributed to the running of a workshop on the management and taxonomic description of banana germplasm, organised under the auspices of Bioversity International, at the National Research Centre for Banana, at Trichy, India 4-14 December 2014. This workshop aimed to improve description and classification of banana germplasm, to help in its use internationally in evaluation and breeding. Participants from 15 countries attended.

Professor Andre Drenth arranged the signing of a Memorandum of Understanding between the University of Queensland and the Guangxi Academy of Agricultural Sciences in China to foster closer collaboration and to enable exchange of material.

Deliverable 2 – diagnostic support
Effective diagnostic support is critical to biosecurity in Queensland's plant industries. Incursions of viruses and other pests are a major threat to key industries. Molecular diagnostic support was provided in collaboration with DAFFQ to identify and confirm widespread "capsicum chlorosis tospovirus" (CaCV) infection in a commercial tomato field in Bundaberg district. The first complete genome of an Australian isolate of CaCV was determined and found to contain unique features, which may be useful for tracking specific virus strains. This data has been accepted for publication in the journal Archives of Virology. PhD student Shirani Widana Gamage is using this information to identify plant defence response genes, which may be used as novel disease control targets.

A most serious biosecurity threat to the Australian tomato, potato and capsicum industries (zebra chip disease and its insect vector) was identified on Norfolk Island as part of a Federal DAFF project by Drs Andrew Geering and John Thomas. It is the first record of this disease anywhere in Australia or its territories. Entry into Queensland would devastate these industries. Emergency funding from the Plant Biosecurity CRC has been obtained and research is continuing to pursue the hypothesis of source in New Zealand, and to investigate alternative hosts of both organisms.

A foundation for research on rust fungi in Australia has been achieved via an Australian Biological Resources Survey project to produce a 'Morphological and molecular catalogue of rust fungi in Australia', led by Dr Andrew Geering and with major contributions from Dr Alistair McTaggart, finished in December 2014. During the course of this project, over 600 specimens of rust fungus were collected from all states and three territories (ACT, Northern Territory and Norfolk Island) of Australia. Every specimen has been incorporated into the Queensland Plant Disease Herbarium in Brisbane (Herbarium Code- BRIP; Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry). During 2014, seven scientific papers were published based on this research.

Deliverable 3 - citrus
Black spot disease poses a major threat to profitability of citrus. The Joint Florida and Australia citrus black spot research project (CT13021) has field trials underway in central Queensland. The leaf litter monitoring carried out over the 2013-14 season will be repeated in 2014-15. Screening for sensitivity to commonly used fungicides has also commenced. The project team has also increased its capacity through PhD candidate Nga Tran who will work on this topic via an Ernest Singer Scholarship.

Deliverable 4 - plant defence responses
Enhanced understanding of plant-disease interactions can generate opportunities for novel disease control methods. In a major study, Dr Geering has discovered a new group of endogenous (integrated) plant viruses called Florendoviruses. Endogenous florendoviruses are present in more than 50% of plant genomes examined so far, and sometimes at very high copy numbers. Endogenous florendoviruses are present in many vegetable species, such as tomato, potato, cucumber and brassicas, as well as several fruit, timber and cereal species. The roles of these endogenous florendoviruses in normal plant metabolism are poorly understood but may be involved in virus resistance or gene regulatory pathways in the plant. This major finding was published during the year in Nature Communications and one student obtained a first class honours on part of this work.

Farming Systems

Deliverable 4 - Grain commodity forecasts
Industry awareness of seasonal prospects and production likelihood is critical for decision-making in relation to marketing and transport logistics. The highly-valued wheat and sorghum regional production outlook reports were produced monthly and disseminated to industry and government agencies via e-mail, webpages and twitter. The inclusion of ground truth data points, collated through the internet-based paddock watch system, resulted in the ability to discriminate among wheat, barley, canola, chickpea and fodder crops across the entire QLD and northern NSW cropping region.

A forum has been organised for early 2015 to bring together researchers, policy and industry specialists within the Agricultural crop monitoring space from across Australia. Garry Fullelove from Agricultural Science DAFFQ will open the proceedings and provide an overview of the day. Industry speakers include GRDC and MLA with the over-arching goal of the forum to bring together the islands of knowledge within the domains of Research and Application within the Agricultural Monitoring Space of Australia. The day will discuss the latest advances for agricultural modelling and sensing technologies for the purposes of cropping, fodder, grazing and land use management and seek to broadly prioritise the research needs for the future.

Pathway 4: Production Costs - minimising the costs of production

Support industries with research and development to improve resilience to disease and weather, and to reduce costs

Our research in this area aims to improve resilience, sustainability and profitability of broad acre dry land and irrigated farming systems in the sub tropics and tropics. Research focal areas include soil fertility and health, and weed management

Soil Fertility and Health

Deliverable 1 – Conducting nutrient response field experiments in grain crops
Optimising response to nutrients is critical to resilience and profitability in Queensland's grain industries. The field program defining the responses to P, K and S in grain crops continued despite the challenging seasonal conditions, with crops successfully established and grown through to harvest in 11 out of the 12 trial sites in Qld. The NSW arm of the program was less effective due to the lack of an effective deep placement rig in that local area, with only 4 canola trials established. However suitable equipment has since been procured.

Deliverable 2 – Conducting nutrient response field trials in cotton
Optimising response to nutrients is critical to resilience and profitability in Queensland's cotton industry. We are in the final cotton season for our existing P and K nutrition project, and the lack of planting rain has limited trial work to irrigated sites in Qld. Given the evidence of poor root activity in fertilized hills in the main part of the growing season, and hence poor fertilizer recovery, we are focussing on the possibility of using foliar P, and possibly K, to supplement P and K acquired from the soil. We are also exploring a technique using relative abundance of a naturally occurring K-surrogate (Rubidium) as a way of quantify the crop K recovered from soil reserves or applied fertilizer. If successful, this technique will be a great advantage in future studies exploring cotton root activity and nutrient acquisition.

Deliverable 3 – Quantify and communicate benefits of new N fertilizers and use strategies
N fertiliser is a major input cost in field crops. This research focuses on testing management strategies likely to deliver improved fertilizer NUE, maintained or improved productivity and reduced greenhouse gas emissions for industry. The work is testing the benefits of legume N and the deployment of advanced N fertilizer formulations (especially urea with nitrification inhibitors, which are commercially available and seem very effective at reducing N_2O emissions), as well as continuing the on-farm trials to optimise N inputs and quantify total N losses. Currently the new fertilizer technology costs approximately 25% more/kg N applied, and so we are testing whether lower emissions and gaseous losses will allow lower N rates to be applied, thus countering the higher cost. We are conducting similar research on fertilizer NUE in cotton through a CRDC-funded PhD student.

Deliverable 4 – Promote economic benefits of new nutrient management strategies to grains industry
Promotion of economic benefits of research outcomes on nutrient management strategies is critical to industry adoption. We continue to work with DAFFQ staff in the development of a spreadsheet-based tool to help farmers and advisers assess the economics of deep fertiliser placement – primarily of P at this stage. The DSS being developed looks like it has real potential for broader application across other nutrient inputs and for other industries.

Deliverable 5 – Completion of publications and enrolling a higher degree student
Findings on agronomic management strategies for P and K as well as the economics of deep application were presented in papers at the GRDC updates (July and August), and at the Cotton Consultants update (July) and the Cotton conference (August). Additional papers and presentations on N management have been made at the cotton industry N workshop in Goondiwindi in August and at the national Soils Conference in Melbourne in November.

A new PhD candidate (John Smith, CSD) has commenced his work to quantify N losses and NUE in irrigated cotton systems on the Darling Downs, with his initial year comparing flood and overhead irrigation management on crop N recovery. The importance of this work has been highlighted by recent cotton industry workshops highlighting the need to improve N management and NUE.

Other points to note –
Work on potassium nutrition has attracted international attention and Professor Bell is an invited presenter at the International Soil and Plant Analysis Conference in Hawaii in Jan 2015.

Similarly, expertise in soil and cropping systems management has resulted in our being asked to develop an ACIAR-funded project to look at ways of improving the productivity and sustainability of maize grown on sloping lands in the Mekong region (Vietnam, Laos and Myanmar) commencing in 2016. An offshoot of this work will be to allow us to focus on the extent to which relay/rotation crops of grain or forage legumes can contribute to the soil N supply – an issue just as important in our rainfed systems in Australia.

The research team participated in a webinar run by the Burnett Mary Regional Group (BMRG) highlighting the work under the Action on the Ground program of the Carbon Farming Initiative. Our presentation provided a broader science context to the work being conducted by BMRG, in collaboration with Neil Halpin in DAFFQ and staff from CQU and DSITIA. Professor Bell is an external reviewer and technical adviser to a number of projects in this initiative.

Finally, our work in sugar farming systems and recent move into N management has led to an invitation to both contribute to and lead a review on N management in the Australian sugar industry. This was undertaken during the period from July-Dec 2014, with the final synthesis report delivered to SRA and DoE in late December 2014. This report will inform future R&D investment from the perspective of both productivity and environmental outcomes in coming years.

Weeds

Deliverable 1 – New weed management tactic
Managing weeds is critical to the on-going profitability and sustainability of crop production systems. In order to improve weed management strategies, alternative knockdown and residual herbicide

options for the control of summer grass weeds have been identified. Non-chemical management approaches of strategic tillage and cover crops have been investigated for the improved control of key northern region weeds. Most forms of strategic tillage reduced seedling emergence through seed burial and cover crops effectively smothered emerging weeds, reducing their growth and seed production. Both tactics thus have potential to reduce the reliance on herbicides and thereby reduce the increase in herbicide resistance, and both tactics lead to a more rapid decline in the weed seed bank.

Deliverable 2 – Better understanding of weed ecology
Understanding weed ecology is a pre-cursor to developing effective management tactics, especially for herbicide resistant weeds. An initial survey (on-going) of glyphosate-resistance in common sowthistle is providing useful information on the level and spread of resistance throughout the region. Results will be extended to industry via the project's electronic newsletter and presentations. As a result, farmers and agronomists will be aware of the distribution of resistance throughout the region, which serves as an impetus to improve management of this weed.

Deliverable 3 – Decision support model for managing herbicide resistant weeds in cotton
Effective management of herbicide resistant weeds has become a prime concern in grain-cotton farming systems and is a major threat to system resilience. Work has been initiated on modifying the proven RIM (Ryegrass Integrated Management) model for awnless barnyard grass in cotton systems.

Deliverable 4 – Screening wheat and barley lines for herbicide tolerance
Effective herbicides remain a critical component of weed management tactics. It is critical to ensure that herbicides do not generate crop damage in new varieties. Ten advanced wheat varieties and six barley varieties have been screened for tolerance to important herbicides used in the Northern Region. Herbicides used in wheat were metsulfuron, metsulfuron + MCPA, fluroxypyr, and metsulfuron-methyl. In barley, metsulfuron, metsulfuron + MCPA, fluroxypyr, and tralkoxydim were used. This work provides farmers and agronomists with information to enable decisions to be made regarding the best herbicide applications for specific varieties.

Other points to note –
New projects related to national approaches to management of weed herbicide resistance have been designed and submitted to GRDC in response to recent funding calls. The UQ-DAFF weeds team is playing a key role in the northern grains region in these projects, along with NSW DPI. The projects involve collaboration with lead groups at UWA and UA and focus on topics of weed seed management (at harvest), fallow and in-crop management tactics, and weed ecology. Initial submissions were successful and detailed project submissions are due in Jan 2015.

Key Risks

Seasonal conditions provide a key risk to successful undertaking of field research activities. In this period, dry conditions have impacted some grain crop research though difficulties in establishing field trials and severe hail storms in Brisbane have caused damage to key glasshouse facilities (eg Ecosciences precinct), hindering some plant biosecurity studies..

CENTRE DIRECTOR: Professor Graeme Hammer Signature:

DAFF GM/GMs Dr Garry Fullelove Signature/s: G. Fullelove

24.2.2015

Dr Michael Kennedy

Reporting Document

Agricultural R&D – Six monthly Report

Queensland Alliance for Agriculture and Food Innovation

Centre - Centre for Animal Science

Performance Highlights for July to Dec 2014
Objective - Improve industry performance through innovation

The Centre for Animal Science is focused on key areas as identified in the Annual Research Plan aimed at supporting the growth of livestock industries in Queensland in the areas of Productivity, Disease Diagnosis and Health Management and Securing markets through best practice in animal management and welfare. The Centre for Animal Science has made considerable progress in all of these areas in beef cattle and also in the rapidly expanding pork and poultry industries in Queensland.
A key challenge ahead is to maintain the current rate of progress in the face of considerable reduction in the northern beef industry funding for on farm research due to the drought and resulting fall in revenues. Efforts are being made to engage key industry groups and leverage funds through Federal Government and other sources of funding.
Note: all matters reported represent work undertaken in the reporting period by the group.

Pathway 1: Resource availability - securing and increasing resource availability
Use soil, water, plant and animal science to ensure ongoing resource availability Provide modern, efficient research infrastructure to support all providers of agricultural RD&E
Pathway 2: Productivity - driving productivity growth across the supply chain
Establish Queensland as an international leader in subtropical and tropical agriculture by developing: a five-year agriculture RD&E strategy focusing on beef, horticulture, sugar and broadacre crops new knowledge, products, technologies and processes to lift productivity across the supply chain Encourage the uptake of research and development to deliver benefits to all Queenslanders Maximise RD&E impacts and investment through effective partnering arrangements

QAAFI output B1 - Increased reproductive efficiency and performance of tropically adapted livestock

Significant outcomes in a number of areas of research have occurred in the past six months, which enhance our ability to breed animals for increased reproductive performance as detailed below:

Progress against each of the Annual Research Plan (ARP) Deliverables (in italics) in this theme area is as follows:

Better Gene Marker Adoption in Northern Herds: *Better integration of genotypic data from Brahman and admixed tropical composites to deliver better genetic estimates and increase rates of genetic improvement.*

- **Increased productivity in tropical beef herds.** Methods for beef business evaluation and for identification of factors limiting performance and their underlying causes have been developed out of the Cash Cow project. The project team continues to invest heavily in delivery of the project outcomes to the beef industry, as reflected in the project derived methodologies that are now underpinning multiple beef extension projects across northern Australia, to increase the conception and weaning rates in beef cattle herds. The follow on increase in cattle production will drive beef industry productivity and profitability.

- **Increased productivity in northern beef using genetics.** Northern Australian pastoral production systems are generally characterised by low cost production of relatively low quality and low value beef. The introduction of the Wagyu breed is improving the returns in many northern production systems by allowing production of much higher valued beef. A "Within herd" genetic evaluation has been completed for the Australian Agricultural Company. This evaluation system provides routine breeding values for their Wagyu population on 17 economically important traits including, growth, feed efficiency and carcass quality. This will allow for substantial increases in the rate of genetic gain for these economically important traits.

Better Gene Marker Adoption in Northern Herds: *An economic model for the incorporation of gene marker technology on consumer eating quality of beef balancing consumer satisfaction with cost of implementation.*

- **Increased profitability through consumer satisfaction.** Part of the valuing process for a beef carcass produced in northern Australia is to estimate the *Bos indicus* content of the animal, with higher content resulting in price downgrades due to poorer eating quality when using the Meat Standards Australia (MSA) guidelines. A project entitled "Utilising genetic markers to improve the understanding of the relationship between *Bos indicus* content and consumer eating quality" has recently concluded with the submission of the final project report to Meat and Livestock Australia. The project determined that the current system of using an estimate based on hump height was adequate for use in standard MSA grading system for beef products. However where more accurate estimates are required, such as in improving MSA grades in breeding programs, genetic marker based estimates of breed composition should be used. These findings will enable northern beef producers to maintain and increase market share by providing consumers with a more desirable product.

- **Increased fertility in tropical beef herds.** A collaborative project between QAAFI and the Universidade Federal de Viçosa (UFV, Brazil) studying the genetics of fertility in *Bos indicus* cattle has continued through 2014. The first joint UQ-UFV project student, Aline Camporez, was enrolled during 2014. Aline Camporez submitted her first conference paper to the World Congress on 'Genetics Applied to Livestock Production' (Champaign, USA). Aline also completed the requirements for confirmation of PhD candidature in November 2014. An additional visiting student, Mayara Morena, within the same project has also commenced work within QAAFI during November 2014.

Better Gene Marker Adoption in Northern Herds: *Improved methods for within herd genetic evaluation to deliver better genetic estimates and increase rates of genetic improvement.*

- **Increased fertility in tropical beef herds.** Continuing genetic evaluation of novel reproductive traits in seven industry seedstock herds, representing the three largest tropical breeds (Brahman,

Droughtmaster and Santa Gertrudis) in northern Australia, has resulted in favourable preliminary estimates of genetic heritability for reproductive maturity traits in female cattle. Evaluation of traits in young male cattle is in progress. Further analyses have also identified that timing of reproductive maturity trait measurements may be breed and region specific. These are important findings which support the use of genetics to decrease the generation time in these breeds of cattle. A decreased generation time will give the beef industry the capacity to more rapidly adopt desirable production traits based on genetic testing.

QAAFI output B2 - Improved sustainable growth pathways through optimised nutritional inputs

Improved Nutrition: Improved systems to optimize cattle for growth and reproduction.

- **Improved weight gain in cattle.** Management of phosphorus nutrition of the beef breeder herd has been facilitated by showing that high efficiency of phosphorus supplementation immediately post-weaning (equivalent to the late wet and early dry seasons); increases in cow live weight by 10-20 kg per month with benefits for performance and robustness during drought. This is an important outcome for an ongoing Meat and Livestock Australia funded project.

Pathway 3: Markets - securing and increasing market access

Undertake research and development to help maintain and/or expand market access
Support industry to produce and supply products that meet or exceed market expectations

QAAFI Output A1 - Development of alternatives to traditional husbandry procedures to enhance animal welfare

- **Enhanced animal welfare through partnering.** Effective partnering arrangements in animal welfare research, development and extension continues through representation on the Steering Committee of the National Primary Industries Animal Welfare RD&E Strategy and participation in the annual forum for the identification of potential projects for cross-sectoral support from the beef industry.

QAAFI output A3 – Management of zoonotic diseases and toxins in livestock populations and products for improved food safety

-

Pathway 4: Production Costs - minimising the costs of production

Support industries with research and development to improve resilience to disease and weather, and to reduce costs

QAAFI output A2 - Disease diagnosis and health management in the tropics

Significant outcomes in a number of areas of research have occurred in the past six months which enhance our capacity to diagnose and manage disease in livestock to reduce the cost of production are detailed below:

Progress against each of the Annual Research Plan (ARP) Deliverables (in italics) in this theme area is as follows:

Improved Diagnostics.

- **Improved pathogen detection in pigs.** Negotiations with the Australian Centre for International Agricultural Research for a new pig disease research project ($1.7 million) have been completed and contract documents are now with the University of Queensland for signing. The proposal will deliver a suite of next generation diagnostic assays for the Australian pig industry that will provide rapid and specific diagnostic tools for respiratory diseases (a disease complex which has been estimated to cost more than $100 per sow per year in affected herds).

Improved Health Management.

- **Improvement in the health of intensively reared pigs.** Two Pork CRC research projects, with over $300,000 in funding, have commenced. Both projects are aimed at reducing the economic losses associated with respiratory diseases in intensively reared pigs. The targeted diseases include Glässer's Disease, porcine pleuropneumonia and pasteurellosis. A typical severe respiratory disease has been estimated to cost $100 per sow per year in an affected herd.

Improved Health Management.

- **Improvement of antimicrobial stewardship in pigs.** A technology for testing for antimicrobial resistance in *Haemophilus parasuis,* a major pig pathogen, has been developed during this half year. Current collaboration with laboratories in Europe and the USA (lead by Dr C. Kehrenberg from the University of Veterinary Medicine in Hannover, Germany) is seeking to now transfer this technology to veterinary laboratories around the world by having an international standards authority accept and recognise the technology.

A new approach for the molecular genotyping of tick fever pathogens developed to improve the monitoring of tick fever vaccine breakdowns.

- **A new genetic test for monitoring vaccine performance.** Tick fever costs beef producers approximately $30m annually to manage. A project was developed and funded through Biosecurity Queensland to develop modern methods for genotyping *Babesia bovis*. A report was submitted (September 2014) to Tick Fever Centre (TFC, Biosecurity Queensland) defining improved methods for *Babesia bovis* genotyping to support their live vaccine monitoring of vaccine breakdowns (disease in vaccinated cattle). This research was initiated with University of Queensland funding and subsequently continued through additional funds provided by TFC to deliver a protocol for technology transfer. The research included input from an Honours student (Ammielle Akim Kerudin, 2013) to translate her research into user-friendly assays for TFC. The ability to confirm vaccine breakthroughs will enable the current Department of Agriculture, Fisheries and Forestry to monitor live vaccine outbreaks locally and in export cattle.

Evaluation of 10 novel peptides in 2 cattle tick challenge trials for the identification of new cattle tick vaccine antigens.

- **Improved parasite control through vaccination.** Ticks and the diseases they carry cause approximately $175m in costs to cattle enterprises in northern Australia. Following Beef CRC research, a project funded by MLA was planned to screen all potentially protective peptides individually in trials from April 2014 – December 2017. The first MLA funded trial was completed (August 2014) and the Milestone accepted (November 2014) supporting the on-going screening of novel tick vaccine candidates previously identified during the Beef CRC research. Two vaccine candidates were selected for the future development of a 'vaccine cocktail'. Planning for the second trial has commenced and to start at the Queensland Animal Science Precinct (QASP) in January 2015. An effective tick vaccine will bring approximately $98m in benefits to the northern beef industry.

Improved Diagnostics.

- **Improved disease detection in cattle.** A collaboration with the World Organisation for Animal Health (OIE) Campylobacter Reference Laboratory at the University of Utrecht (Netherlands) was confirmed which will enable the development of a new assay for the diagnosis of bovine genital campylobacteriosis. A preliminary proposal has been prepared for industry and/or commercial investment negotiations and submitted to Meat and Livestock Australia for comment (December 2014).

A best-practice manual produced for the improved management of bovine respiratory disease (BRD) in cattle feedlots leading to reduction in cost of production.

- **Identification of new pathogens for disease management.** Bovine respiratory disease

management (BRD): A study to determine the role of *Mycoplasma bovis* in the development of BRD in feedlot cattle was completed in October 2014 with the PhD candidate Meghan Schibrowski submitting her PhD thesis. The study demonstrated that *Mycoplasma bovis* contributes to the risk of feedlot cattle being diagnosed with BRD. Prior to this research, *Mycoplasma bovis* was considered to mainly cause respiratory disease in younger cattle prior to arrival at feedlots. Knowledge of the specific pathogens involved in BRD will enable more specific and effective treatments to better manage this disease which results in losses of between $60-100m annually. A new project will commence in January 2015 to identify effective antimicrobials for treating *Mycoplasma bovis* related BRD.

A best-practice manual produced for the improved management of bovine respiratory disease (BRD) in cattle feedlots leading to reduction in cost of production.

- **Increase productivity through improved disease management.** Bovine respiratory disease management: The review final report for the National BRD Initiative to improve disease was completed December 2014. Through consultation with Meat & Livestock Australia, feedlot industry representatives and the veterinary health industry the project team are now working on recommendations and a decision support tool for feedlot operators to optimise the management of BRD in their enterprises. It is anticipated that the decision support tool will be available for industry evaluation in the next 12 months.

Proof of concept established for activity of new insecticidal compounds against buffalo fly.

- **Activity of new insecticidal compounds against buffalo fly.** Infestation with buffalo flies is estimated to cost the northern beef industry $78m annually and has potential animal welfare implications. Control relies functionally on the availability of effective chemical treatments, but resistance has developed to a number of the major chemical groups used for control. Potential new control compounds were tested in contact and feeding assays. Although a number of the compounds showed significant activity at higher concentrations, particularly in the feeding assays, none were sufficiently toxic in comparison with currently available options to warrant further development.

- **Improvement of preparedness for screwworm incursions.** The Old World screw-worm, *Chrysomya bezziana* (OWS) is one of the most serious exotic pests threatening Australia's livestock industries and is endemic in a number of northern neighbouring countries. Bio-economic modeling indicates that direct producer losses in the northern cattle industry alone could be in the order of $400 million per year if screwworm were to become established. The AUSTVETPLAN Screw-worm Fly Disease Strategy indicates a plan consisting of containment with chemical treatments and eradication using sterile insect release in the event of an incursion. However, there is no longer any operational OWS sterile insect production facility anywhere in the world and instigation of a program would most take at least two years. During that time, containment and eradication of an infestation would be almost totally dependent on effective chemical treatments. The final report for MLA project B.BAH.0004, 'Chemical containment and eradication of screwworm incursions' has been completed and submitted. This project has identified insecticide formulations that can provide much longer protection than those currently available. This outcome will significantly improve preparedness for a screwworm incursion and enhance the biosecurity of Australia's livestock industries.

Key Risks

Key risks and mitigating actions for the quarter should be noted. Need to state whether actions to mitigation previously reported key risks have been addressed and if not, why not. Report if Deliverables will not be achieved on time and why. If there is variation to the ARP DAFF will need to sign off.

Risk: Continuing drought in central and northern Queensland may impact operations on Spyglass and other research stations.
Action: Liaise with DAFF management to ensure projects can continue or develop contingency plans with DAFF and funding organizations.

Risk:
Action:

Have the actions from the previous 6mth report been addressed?

CENTRE DIRECTOR: Stephen Moore. Signature:

DAFF GM/GMs Signature/s:

Dr P W Johnston
General Manager
Animal Science

24/2/15

Reporting Document

Agricultural R&D – Six-monthly report

Queensland Alliance for Agriculture and Food Innovation

Six monthly Report

Centre – Nutrition and Food Sciences

Performance Highlights for July to Dec 2014
Objective - Improve industry performance through innovation

During the period July – Dec 2014, the Centre for Nutrition and Food Sciences has made significant progress against deliverables in the 2014/15 Centre Annual Research Plan. These are detailed below, grouped by alignment to the Queensland Agriculture Strategy (Pathways 1-4). The Centre's work is focussed on the creation of high value products through R&D that targets (a) increasing the demand for, and value of, harvested product, (b) identifying new market and post-harvest processing opportunities for Queensland agricultural products, and (c) improving consumer demand through enhanced quality and value of agriculture-derived food products in both domestic and export markets.
These approaches are central to developing and maintaining high value markets and products at appropriate price-points to deliver attractive returns to Queensland Agri-food industries. Training of post-graduate research students is also an important part of the Centre's program; student projects drive many of the activities as well as providing highly skilled graduates for the sector (currently more than 40 enrolled PhD students). Particular emphasis is paid to communicating results and opportunities at technical conferences and both industry and public fora, as well as the development of advanced tools in e.g. sensory, compositional, safety, and nutritional analyses of foods.

Pathway 1: Resource availability - securing and increasing resource availability
Use soil, water, plant and animal science to ensure ongoing resource availability Provide modern, efficient research infrastructure to support all providers of agricultural RD&E
Pathway 2: Productivity - driving productivity growth across the supply chain
Establish Queensland as an international leader in subtropical and tropical agriculture by developing: a five-year agriculture RD&E strategy focusing on beef, horticulture, sugar and broadacre crops new knowledge, products, technologies and processes to lift productivity across the supply chain Encourage the uptake of research and development to deliver benefits to all Queenslanders Maximise RD&E impacts and investment through effective partnering arrangements

Increased demand for and value of harvested product

Work in this area involves defining and quantifying market appropriate attributes, and devising measurement methodologies for efficient selection of fit for purpose varieties.

The scope includes all grains and horticulture crops, and targets include selection for enhanced properties as well as methods for improving efficiency of selection in breeding programs.

Progress against each of the ARP Deliverables (in italics) in this theme area is as follows:

1. Identification by June 2015 of one new quality characteristic with the potential to increase crop demand for each of barley and sorghum.

Barley. The Queensland beer industry is worth around $2b in value-add through the hotel and restaurant trade and liquor outlets. One of the main consumer assessments of beer quality is beer foam. Our current research is investigating the effects of lower malt modification while retaining good beer foam. Through a project jointly funded by UQ, Joe White Maltings and Lion Co (XXXX), we are investigating the full profile of sugars and proteins from barley malt to the final beer quality to understand the possible changes that could affect foam when a lower modification malt is used. The lower malt modification offers a major savings in energy and increased production for the malt company, but it is critical that these lower malt specifications don't impact on beer quality including foam. Preliminary results indicate while there is little change in sugar profiles (which means the yeast still has lots of food for fermentation), the lower modification does potentially change the protein profile which contributes to the foam. A presentation has been delivered to the industry partners at a recent event at Castlemaine Perkins. Another round of experiment will be completed before June 2015 and the next phase of this research will be an ARC Linkage grant to be submitted in late 2015.

Sorghum. There is a growing demand for gluten-free and healthier foods. Sorghum fits both those requirements and in particular it has very high levels of phytochemicals which would put it into the healthy whole-grain class. The interest in sorghum is shown with the recent release of a gluten-free 'Weet-bix' from Sanitarium which contains sorghum. Phytochemcials are associated with reduced risks of some cancers as well as heart and other health issues. Our research is investigating the range of phytochemicals in the current commercial hybrids as well as screening a broad range of genetically diverse sorghum to identify genetic and environmental effects on phytochemical levels. The interest in sorghum for food is growing internationally with China purchasing around 800,000 tonnes of sorghum in 2013/14 (approx. $200 M farm gate) for food and a traditional fermented spirit. The interest in the food and spirit products derive from the levels of starch and specific tannins found in Australian sorghum. The Chinese market is indicating a preference for waxy type, high tannin sorghums. The results of our current profiling will provide the QAAFI/DAFF pre-breeding program and private breeding companies with data on the potential to develop hybrids suitable for this growing market specifically in the area of tannin levels. Final results will be available by June 2015 and outcomes will be presented in both scientific papers and at the annual AusSORGM Industry meeting in August 2015.

2. Phytochemical screening to identify increased food value opportunities for strawberries and sorghum by June 2015.

Strawberries: 6 new strawberry breeding lines (QDAFF breeding program) and two commercial cultivars have been screened for phytochemicals. Breeding line (BL) 2006-221, featuring a pronounced dark fruit colour, exhibited outstanding anthocyanin content (~2.5fold of that found in commercial cultivars). Another BL (2011-210) was found to have ~1.4fold higher levels of ascorbic acid (vitamin C) than the commercial cultivars. Anthocyanins and ascorbic acid are regarded as bioactive compounds/antioxidants with potential health benefits for humans. These promising initial results were presented as a poster at the 38th Annual Scientific Meeting of the Nutrition Society of Australia in Hobart in Nov 2014. A manuscript will be submitted to a peer-reviewed journal by June 2015. A follow up meeting with DAFF strawberry scientists and QLD Strawberries to discuss future work and funding opportunities is scheduled for January 2015.

Sorghum: 20 genotypes and field rep's were screened for their phytochemical composition. Shawaya black, a dark/black genotype, had the highest amount of phenolic compounds and the lowest in vitro starch digestibility (release of glucose). Results were partly presented at the AusSORGM 2014 Industry meeting and the 64th Annual Grain Science Conference in August 2014. A new Master project is scheduled for

Feb/March 2015 and results will be presented at AusSORGM 2015 and at least another Cereal/Nutrition Conference next year. Discussions with Glen Fox, Ian Godwin, David Jordan and Alan Cruickshank (DAFF) are in progress to develop a research proposal for "Sorghum for Food" in early 2015.

3. Four Queensland rice species characterised sufficiently to establish potential industry suitability in domestic and export markets by June 2015.

Australia grows four species of wild rice with large quantities growing wild in swampy areas in Northern Queensland. Three of the species are perennial and one annual. It is a summer crop with seeds being hand harvested in April and May depending upon the wet season. All four species still maintain the wild seed shattering phenotype. Current data from the QAAFI Centre for Plant Science (Professor Henry) indicates through genome studies, that one of these species may be the progenitor to domesticated Asian rice. There is research currently being conducted to evaluate these four species for their cooking and eating properties, based in a Thai style cooking procedure (PhD student). The eating quality will include sensory evaluation but larger quantities of seed are required for the sensory trials and increased seed production is being carried out over the 2014/15 summer in a glass-house at DAFF Leslie Research Facility in Toowoomba. Final results on the suitability of these species as a human food will be available by June 2015.

Pathway 3: Markets - securing and increasing market access

Undertake research and development to help maintain and/or expand market access
Support industry to produce and supply products that meet or exceed market expectations

New market opportunities and processes

This theme area aims to identify, develop and deliver foods and ingredients that create market opportunities applicable to increasing value for Queensland.

The scope includes (1) developing new food and ingredient opportunities for Queensland crops through understanding consumer drivers and market opportunities, and (2) value addition through identification of mild processing and preservation treatments which maintain 'as fresh' sensory properties and/or enhance nutrition attributes.

Progress against each of the ARP Deliverables (in italics) in this theme area is as follows:

1. Creating one new market opportunity for Kakadu plum by June 2015.

To support the development of new market opportunities for Kakadu plum, for the first time Kakadu plum processing into puree occurred in the Northern Territory with an indigenous women's group in Wadeye, Darwin. Processing was done during the 2014 harvesting season. The processed puree was utilized by the farmed prawn industry in Australia to extend shelf life of cooked chilled prawns. To further explore market opportunities PhD candidate Mridusmita Chaliha was appointed in July 2014; her study will use metabolomics as a tool to further characterize Kakadu plum and assess the potential of application in the food and health sectors.

2. Identification of industry-applicable functional ingredients from both lemon myrtle and anise myrtle by June 2015.

A literature review on the current nutritional and health properties of lemon and anise myrtle has been completed. This information is being used as base line data to target specific food applications. At this stage the bioactive compounds in lemon myrtle and anise myrtle have been identified to develop a universal plant extract blend against food spoilage yeasts. To facilitate this research, PhD candidate Fahad Alderees was appointed in October 2014 to study the efficacy and elucidate mechanisms of action of lemon and anise myrtle bioactive compounds against a range of food spoilage yeasts.

Dr Nilesh Nirmal was successful in his application for a highly competitive UQ Postdoctoral Fellowship, and will take up his position in January 2015 to study innovative phytochemical delivery in food through nanotechnology. This three year appointment will further strengthen the area of developing plant extracts as functional food ingredients.

A chapter on the "Nutritional and health benefits of Australian native plant foods" was contributed to a cookbook edited by food chef Jude Mayall titled "The Outback Chef – cooking with native Australian ingredients", to be published in 2015.

3. Identification of sensory traits & consumer drivers to create competitive advantage for two Qld agri-products by June 2015

Six key commercial Australian papaya/papaw varietals and one Fijian variety have been evaluated by consumer, sensory and chemical means (Sept-Oct 2014). Consumer preference maps have been developed to understand key preferences of papaya/papaw consuming (and non-consuming) groups in Australia. Consumer segmentation revealed a significant opportunity for the industry in a currently non-consuming papaya group who demonstrated high liking for certain red-papaya varietals.

4. Facilitating new market opportunities through at least 5 activities involving transfer of technical knowledge to industry producers, chefs, consumers, and trainees by June 2015

- An industry report on the papaya/papaw work (see previous deliverable) has been submitted in Dec 2014, identifying new market opportunities for Qld red papaya.
- World Food Day – Native Foods Meets Agribusiness Breakfast (16th Oct 2014) where the native foods industry and major food industry partners were brought together by UQ/CNAFS to facilitate new market opportunities for native ingredients.
- Through the ARC Linkage coffee project and in collaboration between UQ-DAFF, a Qld coffee business has been engaged in a FIAL grant to develop and realise a new commercial product opportunity (completed Nov 2014).

Improved consumer demand through enhanced quality.

The aim of this area of activity is to enhance demand for Queensland produce through creating and validating products with superior nutritional and/or sensory characteristics.

The scope includes (a) nutritional biofortification of crops, (b) validation of nutritional properties of Queensland produce,(c) identification of regional and combination flavour opportunities from sensory and consumer science, and (d) preservation and packaging opportunities for delivering fresh, safe products to consumers.

Progress against each of the ARP Deliverables in this theme area is as follows:

1. Four elite high-zeaxanthin sweet-corn hybrids evaluated for consumer acceptance by December 2014.

Four zeaxanthin-biofortified sweet-corn hybrids developed in the Supergold sweet-corn breeding program were evaluated against a commercial hybrid (cv. Garrison) for consumer acceptability at the Coopers Plains Sensory laboratory. The new hybrids, which were assessed for visual (cooked and uncooked) and eating quality (cooked) by 39 independent consumers were found to be of similar acceptability to the commercial Garrison hybrid. Half of the consumers were informed of the health benefits (slowing macular degeneration) and half remained uninformed. The Supergold hybrids ranged in colour, with the mid-colour hybrid '10-3x14-6' scoring highest with both informed and non-informed consumers. We are currently developing an "Expression of Interest' document with DAFFQ for commercial parties to tender for the further development, production and marketing of this product.

2. Six industry presentations and publications to promote consumer demand in support of Qld agri-food industries by June 2015.

Presentations:

- Science presentation given to industry at the World Food Day – Native Foods Meets Agribusiness Breakfast (16th Oct 2014).
- Presentation to major commercial dairy client on most recent results from a sensory project investigating creaminess and grittiness in dairy (11/12/14)
- Netzel M, Fanning K, Russel D, Topp B (2014) Queen Garnet – a functional plum? Food as Medicines Forum 2014, University of Southern Queensland, Springfield Campus, QLD, Australia,

July 3, 2014.

- Netzel, M, Fanning, K, Netzel, G, Flanagan, B, Gidley, MJ, Topp, B, Russell, D, Stanley, R (2014) Bioactive anthocyanins in Queen Garnet plum – maturity and bioavailability. 6th International Symposium on Human Health Effects of Fruits and Vegetables (FAV Health 2014), Brisbane, QLD, Australia, August 21, 2014.
- Fanning K, Tyler P, Netzel M, Herrington M (2014) SE Region Innovation Grant Case Study #3: Evaluation of consumer acceptability of dark strawberry associated to health profile. DAFF Regional Leadership Team – South East Meeting, Coopers Plains, QLD, December 11, 2014.
- Netzel M, van der Kolk M, Mueller T, Cruickshank A, Fox G, Netzel G, Godwin I (2014) Unique sorghum cultivars grown in Australia – characterising their quality traits and phytochemical profiles. AusSoRGM 2014, O'Reillys, QLD, Australia, July 23-24, 2014.
- Fox G, Mueller T, Kelly A, Netzel G, Netzel M, Cruickshank A, Jordan D, Godwin I (2014) Profiling Australian and international landrace sorghums for potential food quality. Australasian Grain Science Association, 64th Annual Grain Science Conference & AGM, Brisbane, QLD, Australia, August 24-27, 2014.
- Ikram EH, Netzel M, Fanning K, Stanley R (2014) Phytochemicals in different plant parts of Australian papaya cultivars. 29th International Horticultural Congress, Brisbane, QLD, Australia, September 17-22, 2014.
- Bobrich A, Fanning K, Rychlik M, Diczbalis Y, Netzel M (2014) Phytochemical composition in unexploited tropical fruits grown in Queensland, Australia. 29th International Horticultural Congress, Brisbane, QLD, Australia, September 17-22, 2014.

Publications:

- Ikram EH, Netzel M, Fanning K, Stanley R (2014) Phytochemicals in the tissues of Australian grown papaya cultivars. Acta Horticulturae (accepted for publication).
- Netzel M, Fanning K, Russel D, Stanely R, Topp B (2014) Bioactive anthocyanins in Queen Garnet plum – maturity and bioavailability. Acta Horticulturae (accepted for publication).
- Santhakumara AB, Kundur AR, Fanning K, Netzel M, Stanley R, Singh I (2015) Consumption of anthocyanin-rich Queen Garnet plum juice reduces platelet activation related thrombogenesis in healthy volunteers. Journal of Functional Foods 12: 11-22.
- Fanning K, Topp B, Russell D, Netzel M (2014) Western plums make room – opportunities to develop the health profile and functional applications of Asia's plums. Food Asia Pacific, November 2014: 25.
- Fanning K, Topp B, Russell D, Berecry R, Stanley R, Netzel M (2014) Plums: an untapped nutritional source. The World of Food Ingredients, September 2014: 82-83.
- Bobrich A, Fanning KJ, Rychlik M, Russell D, Topp B, Netzel M (2014) Phytochemicals in Japanese plums: impact of maturity and bioaccessibility. Food Research International 65: 20-26.

3 New tools and data used to identify distinctive nutritional, flavour and sensory properties of two Qld agri-food products for industry application by June 2015.

Strawberry. Evaluation of consumer acceptability of dark strawberry associated to health profile: Key-findings of this project (funded by a DAFF Innovation Grant – South East Region) are: The current strawberry market has seemingly developed negative associations with strawberries of darker colour. Evidence shows that providing information can significantly change consumer opinion, and resulting purchase intent of such strawberry varieties. Considering that colour is one of the most influential characteristics impacting strawberry purchase, the results would suggest that educating the consumer of the health benefits of the newly developed strawberry lines would be of paramount importance to its success. Results were presented at the DAFF Regional Leadership Team – South East Meeting on December 11 at Coopers Plains. A follow up meeting with DAFF strawberry scientists and QLD Strawberries to discuss future work and funding opportunities is scheduled for January 2015.

Queen Garnet plum (QGP): Nutrafruit (Licence holder) and the University of Wollongong are partners in a project (titled "Determining dose response variations in human absorption and metabolism of flavonoids from a novel Australian fruit – Queen Garnet plum") which has now started and should lead to a collaborative ARC Linkage grant application in 2015/2016. New research data published in leading international journals, Food Research International and the Journal of Functional Foods has demonstrated

that QGP should be harvested as late as possible to maximise anthocyanins and that QGP juice consumption could significantly reduce thrombogenesis and oxidative stress in healthy humans. These results are very useful for Nutrafruit and The Goodrich Fruit Company (biggest Queen Garnet plum grower in QLD) in terms of positioning QGP as a premium QLD grown product, and in the development of new market opportunities in the functional food/nutraceutical sector. A production of >2200 tonnes in QLD from 2017 is planned (current production is ~200 tonnes). Follow up meetings with Nutrafruit and The Goodrich Fruit Company are scheduled for early next year to discuss future work and funding opportunities.

Coffee. New chemical methods are being developed to measure key flavour components in coffee (will be completed June 2015).

Consumer science. New methods are being developed to understand emotive responses of consumers towards food flavours and food choice, these methods will be applicable to Qld food products (will be completed June 2015).

Sensory science. Novel sensory methods are being developed to measure textural components of foods, these methods will be applicable to Qld food products (will be well underway by June 2015)

4. Application of native plant extracts to improve the quality and safety of sweet corn demonstrated to an industry collaborator by June 2015.

Field samples from North Queensland and infected samples of sweet corn from the retail market were assessed to understand the microbial flora present. Fungal contaminants including moulds and yeasts have been isolated and characterized, and growth inhibition by native plant extracts is in progress. Prototype and factory trials of a spray delivery system will be completed in the next 6 months to develop a commercial application of the native plant extract formulation.

5. Complete the first of three steps to produce high-lycopene tomato parent lines in an elite gourmet background by June 2015.

Nine crosses of red and pink-skinned high-lycopene tomato lines with three elite tropically-adapted gourmet parent lines were conducted to further improve fruit quality. Seed from the crosses was collected and will be subsequently grown at Gatton Research Station in January 2015. The Queensland tomato industry is valued at approximately $250 million, and it is conservatively estimated that tropically-adapted high-lycopene fruit will take 10% of the market, based on improved colour and health benefits (prostate cancer). This crossing is the first of three steps to develop premium parents (pink and red) that can be used for the development of commercial hybrids.

Pathway 4: Production Costs - minimising the costs of production

Support industries with research and development to improve resilience to disease and weather, and to reduce costs

Key Risks

Key risks and mitigating actions for the period should be noted. Need to state whether actions to mitigation previously reported key risks have been addressed and if not, why not.

Report if Deliverables will not be achieved on time and why. If there is variation to the ARP DAFF will need to sign off..

Risk: No risks identified
Action:

Have the actions from the previous 6mth report been addressed? No actions arising

CENTRE DIRECTOR: Prof Mike Gidley Signature:

DAFF GM/GMs: Dr Garry Fullelove Signature/s:

24.2.2015

Dr Michael Kennedy

Queensland Alliance for
Agriculture & Food Innovation
Queensland Bioscience Precinct
The University of Queensland
St Lucia, Brisbane, Australia

Tel: (07) 3346 0551
Int: +61 7 3346 0551
Fax: +61 7 3346 0555

qaafi@uq.edu.au

Working together with the
Queensland Government