

# FARRER MEMORIAL TRUST

ANNUAL REPORT  
2018

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FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND

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THE 2018 FARRER MEMORIAL ORATION

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## FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND

The Farrer Memorial Trust was established in 1911 to perpetuate the memory of William James Farrer and to encourage and inspire agricultural scientists. Initially it awarded scholarships for 'study or research in agricultural problems'. Later it included the delivery of an annual oration and the presentation of the Farrer Memorial Medal to a distinguished agricultural scientist for service rendered in the fields of research, education or administration.

The Director General of the Department of Primary Industries, Mr Scott A Hansen, is the Chairman of the Trust. The other official Trustees are Ms Kate Lorimer-Ward, Deputy Director General, Agriculture NSW of the Department of Primary Industries; Prof. Alex McBratney, Professor and Dean of the Faculty of Agriculture, University of Sydney; and Dr J C Radcliffe AM, CSIRO, Unley Park, South Australia. The non-official Trustees, representing industry, are: Mr M J R Arnott AM, Boorowa, Ms R Clubb, Araluen, and Mr G Mason, Boorowa.

The Farrer Memorial Travelling Scholarships are designed to support overseas travel by post-graduates enrolled for a PhD on any aspect of field crop research. No scholarships were awarded in 2018.

The 2018 Farrer Memorial Medal was awarded to Dr Reg Lance at the University of Sydney, Faculty of Agriculture and Environment on Monday 12 November 2018. Dr Lance delivered the Farrer Oration entitled 'Another Man's Life with Barley'

The text of the 2018 Farrer Memorial Oration is reproduced on page 3 of this report.



The 2018 Farrer Memorial Oration

**ANOTHER MAN'S LIFE  
WITH BARLEY**

Dr Reg C.M. Lance



### Acknowledgements

I would like to thank the Chairman of the Farrer Memorial Trust, Dr Scott Hansen, Director General, the Department of Primary Industries - New South Wales. To the other members of the Farrer Memorial Trust I would like to thank you for bestowing on me this honour. I am very honoured and humbled to accept it.

I would like to thank the NSW DPI Deputy Director General Kate Lorimer-Ward for her very kind words for my introduction and for the presentation of the Farrer Memorial Medal for 2018.

### Dedications

I would like to dedicate this oration to the memories of two of the early United States of America pioneers of barley breeding and genetics: Harry V. Harlan (1882-1944) and Gus A. Weibe (1899-1975).

Harry Harlan. From "One Man's Life with Barley – The Memories and Observations of Harry V Harlan" (1882 – 1944). Harry was a pioneer of the barley agronomy, breeding and early barley germplasm collections. He conducted research into barley genetics, agronomy and breeding with the United States Department of Agriculture.

Harry Harlan and another early barley researcher Gus Weibe collected barley extensively in Ethiopia.

Gus Weibe also worked with the USDA as a barley breeder and geneticist. From 1946 until 1969 he

was the leader of barley investigations for the USDA Agricultural Research Service. He was responsible for collecting at least 1,100 barley lines and land races from Ethiopia. He was the inaugural President of the International Barley Genetics Symposium. The universal Leaf Rust susceptible variety "Gus" is named after him.

My first exposure to the value of barley germplasm collections was to access some 543 Ethiopia barley lines from the USDA collection (Lance and Nilan 1980). Ethiopia is a major "Centre of Diversity" for barley. The variability in this small collection was truly amazing for many agronomic, grain quality and disease resistance traits. Once harvested I screened the population for "acid-soluble viscosities" and selected low and high lines which formed the basis of my PhD thesis studies; "Genetic studies of the beta-glucan content of barley". I have been truly indebted to Ethiopia ever since and have wanted to somehow return my appreciation to them by making a contribution using my acquired knowledge and skills. Through a project between the Ethiopian Institute of Agriculture Research (EIAR) and the University of Queensland (led by Prof. David Jordan and Dr Emma Mace) funded by the Bill and Melinda Gate's Foundation I have now been able to be involved in modernising their breeding programs and in a small way return the favour.



Harry V. Harlan



Gus A. Weibe

## **Introduction**

The transition from public to private barley breeding in Australia has occurred over the past 15 years. Prior to the formation of the Grains Research and Development Corporation barley breeding programs were funded by State Governments and either pre-Barley Research Council or Barley Research Council funding. The commodity Research Councils were amalgamated into the GRDC which was able to then take on a national role for co-ordination and funding. At this stage there were 6 state based programs; Queensland, New South Wales, Tasmania, Victoria, South Australia and Western Australia. The "Waite Institute" program being at the University of Adelaide's Waite Campus.

A transition arrangement saw a rationalisation of the NSW and Vic programs to form Barley Breeding Australia. BBA was the association of three nodes; BBA-north, BBA-south and BBA-west from the DAFQ, University of Adelaide and the DAWA programs. A further transition saw the BBA-west program being privatised to InterGrain Pty Ltd. The DAFQ program has transitioned to a pre-breeding program for foliar disease resistances. The BBA-south program has dispersed with some of the breeders taking positions with either AGT or SECOBRA Recherches. The fate of the rest of the Waite Institute program as a pre-breeding entity is uncertain at this point in time.

## **Elements for a successful barley breeding program**

Successful breeding programs require the integration of a number of disciplines vis-à-vis:

### ***Germplasm:***

Any program relies on the introduction of new genetic material whether it is a modern cultivar or lines with desirable traits. The continued introduction of new genetic material by such programs as AGG managed within is fundamental to the future growth and sustainability of the breeding programs. My post graduate studies began with utilising land races from Ethiopia. My current research and development into discovering and pyramiding multiple disease resistance genes into modern pre-breeding germplasm relies inexorably on new germplasm found in various international collections. Some of the resistant lines we are currently crossing into our Nested Association Mapping (or NAM) populations are lines which were originally collected and handled by either Harry Harlan and/or Gus Weibe many years ago.

### ***Yield evaluation and agronomic assessment:***

Previously the Waite and DAFWA programs had extensive investments in people and machinery to plant, manage and harvest extensive yield trials. Now the preference is to outsource to private companies such as Kalyx or Eurofins Agrosience Australia.

## ***Quality laboratories:***

Fundamental to being able to evaluate grain and/or malting quality is to have access to a laboratory that can have a high throughput of a large number of samples in an efficient manner. Since the mid-80s I have been fortunate to be associated with two superb barley quality laboratories; at the Waite Institute lead by Lesley MacLeod and Sophie Roumeliotis and at the DAFWA laboratory led by Allen Tarr. The professionalism of their laboratories was fundamental to be able to confidently measure grain and malting quality traits and to subsequently select for improvements.

The advent of NIR technologies calibrated to specific quality traits has enabled the non-destructive and accurate estimations of a range of malting and grain quality traits such as protein, malt extract, colour, etc. In the context of improvements in the rate of genetic gain, NIR technologies, I believe, are just as important as molecular genetic technologies.

## ***Disease screening and evaluation:***

In the past, late stage testing and assessments of the disease resistance profiles of advanced lines was carried out by dedicated pathology groups associated with the breeding programs. It is now imperative that pathology (and molecular genetic) inputs takes place during early generation phases. It is unconscionable to carry forward lines which are susceptible to disease unless they are a part of a germplasm enhancement or parent building program.

## ***Biometricians for advanced statistics:***

Nearest neighbour analysis was my introduction to modern statistical design and analysis. Now, spatial analyses, partial replicates, mixed models, multi environment trials, unbalanced designs and pedigree analyses have become the norm. The impact on accounting for the estimation of the variety performance of traits is spectacular to say the least. Having a co-ordinated and independent approach to the analysis of plant breeding data and assessment of National Variety Trials is paying major dividends and the GRDC should be congratulated for the role and leadership in funding this program and process.

## ***Molecular genetic marker laboratories:***

Molecular genetic markers have made a significant impact on the breeding of all crops including barley. The GRDC invested wisely into the Australian Winter Cereal Molecular Marker Program (AWCMMP) and its predecessors for barley and wheat. The peak of research activity in barley culminated in the publication in a special issue of the Australian Journal of Agricultural Research (AJAR Vol 54 Nov 2003). The barley breeding programs have been able to use marker Assisted Selection for a range of traits from; phenological and agronomic, malting

quality to disease and pest resistance and resistances or tolerance to abiotic stress. Early genetic studies have relied on bi-parental populations. Now more complex population structures such as Nested Association Mapping (NAM) or whole breeding program or germplasm collections to undertake Genome Wide Association Mapping and Selection (GWAS) are becoming the preferred mapping and genetic analyses populations.

The DAFWA cereal breeding programs had successfully utilised an F2 progeny method with a reselection phase in the F5 generation. However the time taken from cross to release is considered too long and strategies such as alternate generations, doubled haploids, single seed descent or “speed breeding” are considered more desirable in reducing “cycle time” (the time taken from baking the original cross to using the progeny in a new cross). The combination of Marker Assisted Selection (MAS) with either conventional breeding, Doubled Haploids (DH) or Male Sterile Facilitated Recurrent Selection (MSFRS) improved both the rate of gain but enables the selection of early generation germplasm with higher genetic worth. The problem encountered was that those technologies could not be applied to the whole early generation program.

The “Breeder’s Equation” should be considered as this encompasses the elements for improving the “rate of genetic gain”; “R” where:

$$R = ih2\sigma_p / \text{years per cycle}$$

“i” is the selection intensity,

$h^2$  is the heritability,

$\sigma_p$  is the phenotypic variance,

$ih^2\sigma_p$  together represents the response per cycle.

In early generations, off season nurseries or the use of doubled haploids or “speed breeding” greatly speed up the early years and may cut 2 – 3 years off the overall cycle time. The modern imperative is to efficiently and effectively improve the rate of genetic gain. Consideration needs to be made to use the new statistical designs and analyses (including pedigrees) of trials and traits to improve heritabilities and “breeding values”. It is also not good enough to just increase the phenotypic variance but to also orchestrate the increase in the desired direction. Again, more detailed analyses of breeding values will facilitate the choice of parents for new crosses.

#### **Varieties – Malting and Feed:**

In the 80s the Australian Barley Industry was facing a dilemma. The domestic malting market required lower levels of malt extract, and lowered levels of starch degrading enzymes or diastase and lower fermentability than was now being demanded in the export markets. Domestic brewing used sugar as the adjunct whereas the export brewers used either malt alone or a starch based adjunct such

as wheat, corn or rice. As such the export markets demanded higher malt extract, higher diastase and higher fermentability. At the same time there was an increasing demand for improved protein and beta-glucan modification resulting in lower malt beta-glucan, lower wort viscosities, and optimal levels of “Kolbach Index”.

Chebec was released as a CCN resistant domestic malting type but did not reach the required extract levels so was rejected as a malting variety. Sloop gained an increase in diastase, of about 25% over Schooner, from the Canadian variety Norbert. Its progeny; Sloop SA and Sloop Vic were the result of crosses incorporating CCN resistance and were released after I moved from the Waite Institute to DAFWA. Both varieties endured for some years.

Shannon was a Barley Yellow Dwarf Virus resistance backcross derivative of Proctor. The source of the BYDV resistance was the Yd2 gene from CIho 3208-1. This accession was originally collected. 17-Nov-1923. Shewa Ethiopia by Harry Harlan. This line was the one that was the subject of BYDV research in California (Schaller et al., 1963). Franklin barley was bred by Wayne Vertigan, derived from a cross between Shannon and Triumph and represented the best quality variety in Australia at the time. It was however, too late in maturity to be widely grown on the southern and western mainland. It should be noted that both the malting quality and the Yd2 gene were carried forward to the newer varieties; Baudin, Bass and Flinders.

Dhow was an early maturing, CCN resistant semi-dwarf barley with high extract from the Japanese variety Haruna Nijo. Although it did not reach major acreage, it did give great hope that high yield, good agronomic performance and excellent export malting quality was achievable (Table 1).

Gairdner barley was bred by Ross Gilmore and Peter Portman at DAFWA but when I arrived in WA I was responsible for choosing a malting variety from amongst 5 candidate lines. Eventually it came down to either Gairdner or Fitzgerald with Gairdner being chosen because of higher and more stable thousand grain weight; i.e. the varieties were very similar for medium quality. Gairdner barley endured in WA and the eastern states for many years, probable less to do with yield and agronomic performance but more to do with the fact that it filled a niche that no other barley occupied.

Baudin and Hamelin were released on the same day. Hamelin, was similar to Stirling (which was the target for replacement) for yield and agronomic performance. Hamelin inherited its superior malting quality from the Canadian variety Harrington but it never took off as a variety, probably because it did not command a higher price.

Table 1: Malting and Feed Varieties Released (see also Figure 1).

Malting Varieties	PBR Granted	Feed Varieties	PBR Granted
Sloop	(1992)*	Chebec	1992
Gairdner	1999	Molloy	1997
Dhow	2004	Doolup	1999
Baudin	2003	Fitzgerald	1999
Hamelin	2003	Keel	2001
Vlamingh	2008	Maritime	2006
Bass	2013	Roe	2007
Flinders	2017	Hannan	2010
Banks	2018+(?)	Lockyer	2010
		Rosalind	2018+(?)

Baudin was a later maturing variety with superior export malting quality. When test samples were sent to China there was significant disbelief amongst malting customers that an Australian malting variety could achieve such excellent quality. Once accepted it has been in high demand commanding a premium price. As far as disease resistance, Baudin had two weaknesses; powdery mildew and leaf rust. After consultation with the Australian Cereal Rust Control Program at the University of Sydney it was decided to limit the eastern states release to regions where it was less vulnerable and a very prescriptive management package had to be put in place to manage the leaf rust susceptibility. On the south coast of WA farmers sprayed for powdery mildew

but new races appeared which were resistant to the triazole fungicides (<https://www.agric.wa.gov.au/barley/management-barley-powdery-mildew-2018>).

The release of Bass and Flinders addressed some of the disease susceptibility issues. Flinders contained two resistance genes for powdery mildew resistance from Cooper as well as Rph20 Leaf Rust adult plant resistance.

The last export quality malting varieties (Baudin, Bass, Flinders and Banks) were selected for improved agronomic performance in that they are early maturing, semi-dwarfs with larger grain and stiff straw.

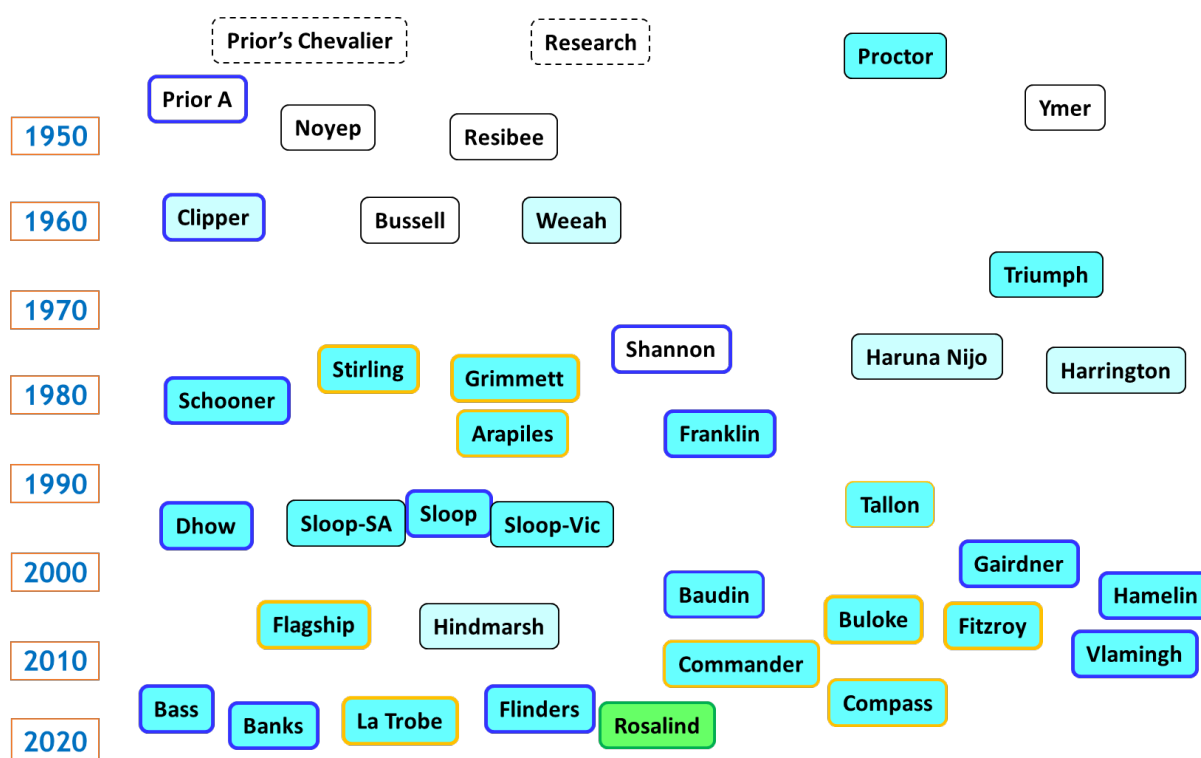


Figure 1: Representation of the release of malting varieties (plus Hindmarsh, a food variety and Rosalind, a feed variety) over the past 70 years in Australia. Those lines with dark blue surrounds are from Farrer Memorial Medal recipients; (Albert Pugsley, Wayne Vertigan, David Sparrow and Reg Lance). There is a significant lineage of varieties through to modern day varieties; Baudin, Banks, Flinders, Dhow, Sloop and Gairdner which have all benefited from their predecessors; Clipper, Prior A, Shannon and Schooner and Franklin.

### Graduate Students Co-Supervised

I have been fortunate to be involved in the co-supervision of a number of PhD students; mostly at the Waite Institute of the University of Adelaide, but also with Murdoch University and now the University of Queensland. Most of these have gone onto have very successful careers.

My philosophy for working with post graduates was to empower them to develop their research and critical analyses skills and to think independently but to be able to work as part of a team.

Table 2: Graduate students

Student	Country	Degree	Description	Result	Year
Mike Sissons	Australia	PhD	Studies of Barley Limit Dextrinase	Passed	1992
Mandy Jenkin	Australia	PhD	The Genetics of Boron Tolerance in Barley	Passed	1993
Jenny Guerin	Australia	PhD	An Investigation of Endopeptidases in Barley	Passed	1993
Ghodratollah Fathi	Iran	PhD	Nitrogen Responses in Barley	Passed	1994
Young Won Choe	South Korea	PhD	Molecular Genetic Markers for CCN Resistance in Barley	Passed	1995
Chengdao Li	China	PhD	Molecular Genetic Markers for Malting Quality in Barley	Passed	1997
Tran van Diem	Vietnam	PhD	Water use efficiency and drought tolerance in barley.	Passed	1997
Jason Eglington	Australia	PhD	Isolation, characterisation and mapping of alternative alleles for malt enzymes from the wild barley progenitor, <i>Hordeum spontaneum</i>	Passed	2003
Retinder Gill	Australia	PhD	Male sterile facilitated recurrent selection in barley: genetic gains and recombination	Passed	2009
Dipika Roy	Pakistan	PhD	Understanding the genetics of spot blotch resistance in barley	Confirmed	2018
Zerihun Tadesse	Ethiopia	PhD	Stem Rust and Stripe Rust resistances in "Vavilov Diversity Panel" Wheats, CIMMYT and Ethiopian Bread Wheats breeding lines with Ethiopian races "in situ".	Commenced	2018

### Current and Future Directions in Barley Improvement

Crop improvement is entering a most exciting phase with the integration and implementation of a range of breeding technologies and genetic biotechnologies. We are moving from using biparental crosses to identify single genes and quantitative trait loci (QTLs) and employing either simple marker assisted selection (MAS) to facilitate the introgression of desirable genes or to more complex pyramiding of multiple simple/single gene traits.

Furthermore, the integration of MAS with either conventional breeding, doubled haploids (DH), "speed breeding" or Single Seed Descent (SSD) with a crossing technology such as Male Sterile Facilitated Recurrent Selection (MSFRS), couples with both genotypic and phenotypic selection, enables a rapid turnover of cycles with "genetic enrichment" phases

to develop populations with a significantly enhanced desirable traits. The hierarchical structuring of crosses and selection for different traits can be referred to as a Reciprocal Recurrent Selection. Phenotypic selection for specific Traits such as Scald Resistance can be done at different nursery sites and then selected progeny combined at a "home" site through crossing.

Genome screening and gene/allele based decision making: The advent of whole genome screening at competitive prices brings the cost of genotyping to be about the same order of magnitude of the cost of two replicates of entries in a yield trial (~\$50). A further reduction in the genotyping costs for a reduced set or sub-set of markers down to \$10 per line will encourage the increase in the more general use of genome wide markers rather than just using markers for gene discovery and early genetic selection intervention.



## Gene discovery and genetic management software

Future breeding management software must include modules for genetic analysis and gene discovery as well as assisting in the design of crossing strategies to enable the pyramiding of desirable combination of traits.

## Pedigree / Trait databases

To be able to make appropriate decisions on the selection of parents for crossing a breeder must have access to a data base with all the traits of interest adequately documented. This should include data on the traits as well as the genes/alleles controlling the traits. A comprehensive pedigree data base permits the understanding of the inheritance of the trait and tracking through populations.

## Future Directions for Barley Disease Resistance Improvement

A major weakness of current Australian barley varieties is the lack of resistances vis-à-vis; MRMS, MR or R for the significant leaf diseases. This includes: Leaf Rust (LR), Net Form of Net Blotch (NFNB), Spot Form of Net-Blotch (SFNB, Powdery Mildew (PM) Additionally we should include Scald (SC) Spot Blotch (SB), Stem Rust (SR), Barley Yellow Dwarf Virus (BYDV), Barley Grass Strip Rust (BGR) and the Quarantine Trait; Stripe or Yellow Rust (YR). We could also add Loose Smut, Cereal Cyst Nematode (CCN), *Pratylenchus* spp. and Russian Wheat Aphid (RWA) resistances.

Table 3: Barley disease resistance ratings for foliar diseases in 2018 (Qld et al.)

Variety	Year PBR	LR	NFNB	SFNB	PM
Gairdner	1999	S	MRMS	S	SVS
Baudin	2003	VS	MSS	MSS	VS
Commander	2010	S	S	MSS	S
Fairview	2010	SVS	MSS	S	R
Scope	2011	S	MR	MSS	MR
Bass	2013	VS	MSS	MSS	S
Compass	2015	VS	MRMS	MRMS	S
Granger	2015	MR	SVS	SVS	R
Spartacus CL	2016	MR	MRMS	SVS	SVS
Flinders	2017	MRMS	MRMS	MSS	R
La Trobe	2017	MSS	MS	SVS	SVS
Banks	2018	S	R	MSS	S
Rosalind	2018	MR	MR	MSS	SVS
RGT Planet	2018	MR	S	S	R

Ratings	R	MR	MRMS	MS	MSS	S	SVS	VS
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A few varieties were released with Rph3 resistance to Leaf Rust (LR) but this gene quickly succumbed to new virulent races and varieties such as Bass, and Fitzroy etc. became VS; a very hard lesson to learn. More recently the use of Rph20 from European and North American sources has given a degree of Adult Plant Resistance and MR ratings.

Net Form of Net-Blotch has proven to be a challenging disease. Genes for resistance have been well documented on chromosomes 6H, 4H and 3H. It would appear that broad QTL resistance on 6H is more complicated and may be resolved into three separate loci (Fowler 2018 PhD thesis).

Spot Form of Net-Blotch resistance has proven to be difficult to find and incorporate resistances. The "classic" gene Rpt4 does not give a low level

of resistance. Newer genes are to be found in germplasm collections. For example, the USDA core barley collection has been screened against four SFNB races, including a race origination from Australia. Resistance to this race can be found in Mongolian land races. The USDA core collection has been genotyped with the older DaRT markers so identifying the new gene location should be relatively simple. The Australian Grains Genebank (AGG) has been systematically introducing this collection (and others) over many years.

Powdery mildew resistance has similarly been a significant problem. Our experience was that the use of the mlo gene resulted in yield reductions of 5-10%. However varieties such as Fairview, Granger and RGT Planet maintain resistant or "R" ratings from using the mlo gene.

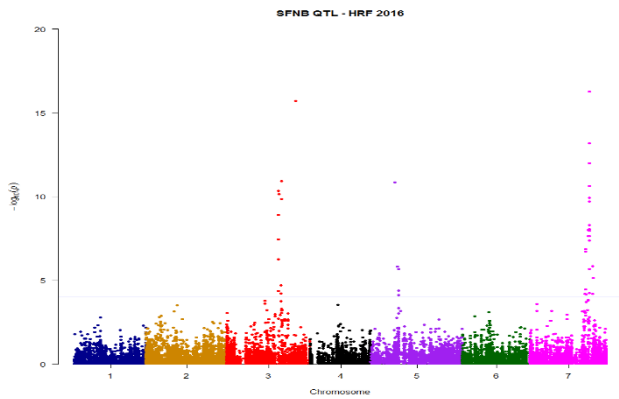


Figure 2a: Spot form of Net Blotch "Manhattan Plots" from NAM\_LR (Fowler et al. 2017 unpubl.)

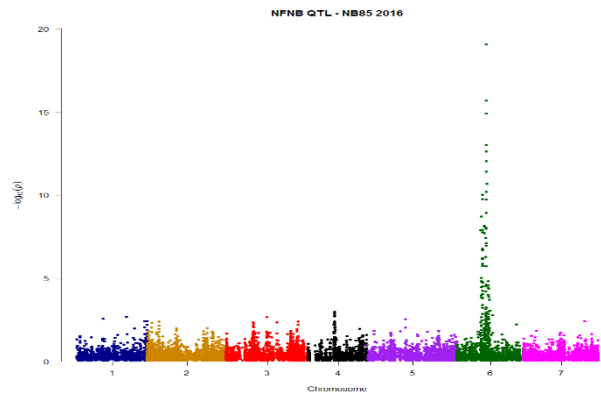


Figure 2b: Net form of Net Blotch "Manhattan Plots" from NAM\_LR (Fowler et al. 2017 unpubl.)

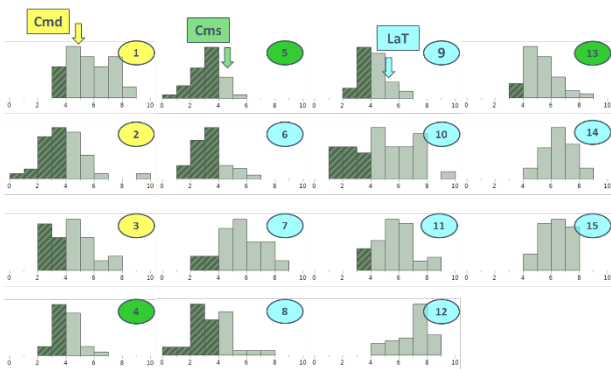


Figure 3a: NAM\_DR : Spot Form Net Blotch (SFNB17) populations. 1- 15. Means for reference varieties: Commander (Cmd), Compass (Cms) and La Trobe (LaT) are given for their respective "first" populations. Populations are coded yellow Cmd, dark green Cms and light blue (LaT). Scale is 0-9 where 0 represents more resistance.

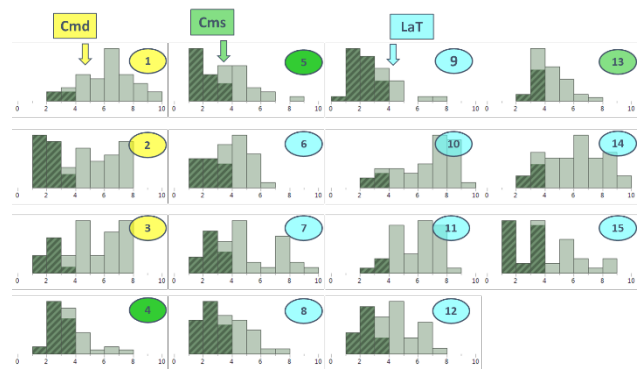


Figure 3b: NAM\_DR : Net Form Net Blotch (NFNB17) populations. 1- 15. Means for reference varieties: Commander (Cmd), Compass (Cms) and La Trobe (LaT) are given for their respective "first" populations. Populations are coded yellow Cmd, dark green Cms and light blue (LaT). Scale is 0-9 where 0 represents more resistance.

A simplified conceptual scheme is represented in the Figure 4. Disease resistance traits are represented by genes AA, BB, CC and DD. Our starting populations are from Nested Association Mapping (or NAM) populations where specific lines have been crossed once to several "recurrent" parents. A second and third round of crossing to the "Recurrent" parent will effectively result in BC2 populations. Populations are both crossed to "recurrent" parents and then selection progeny are intercrossed in pairs of populations e.g. combining AA and BB to give AABB genotype (or A/a;B/b; homozygote or heterozygote selection). In a second population development CC will be combined with DD and CCDD (or C/c;D/d selected) selected. Finally AABB and CCDD are combined and ultimately AABBCCDD genotypes are selected. An additional round of intercrossing may be desirable so the final population in Figure 4 is referred to as BC2 IC2 populations. Selected lines can be taken through several cycles of "Speed Breeding"

The improvement in the overall disease resistance of Australian barley varieties needs to proceed in two phases. The first is the R&D phase of unique gene/allele discovery including gene mapping. The second phase should be the pyramiding of genes into industry agreed "reference" varieties. The integration of a number of breeding and genetic biotechnologies is the preferred path for success. Male sterile facilitated recurrent selection (MSFRS) would be the preferred technology to effectively and efficiently accumulate the desirable disease resistance genes. The Figure 4 represents a simple scheme to illustrate the general approach. The male sterile (*msg6-rob-sex1*) gene block is back-crossed into the "reference" varieties. The *msg6* is used to facilitate the crossing, selection and inter-crossing of populations which have been selected (both genotypically and phenotypically) for different traits. The NAM populations NAM\_LR and NAM\_DR have used three reference varieties; Commander, Compass and La Trobe. All populations are therefore 50%

reference varieties. Two further crosses to “msg-reference” varieties will result in BC2 populations. In the simple scheme, two rounds of crossing and inter-crossing would enable the accumulation of genes for four traits. A necessary extension to the simple scheme is to “self” selected F2 derived lines and then progeny test these for yield, agronomic performance as well as grain quality and NIR predicted malting quality. So not only will selections be made for pyramided disease resistance genes,

but the background reference variety germplasm will be selected for overall performance. As an extension to this approach, breeding companies would be encouraged to develop their own propriety “msg-reference” varieties or lines to enable the rapid crossing of “selected elite populations” into their own material. Again, the approach would be for the companies to utilise “speed breeding” of their own selected F2 derived lines for variety development.

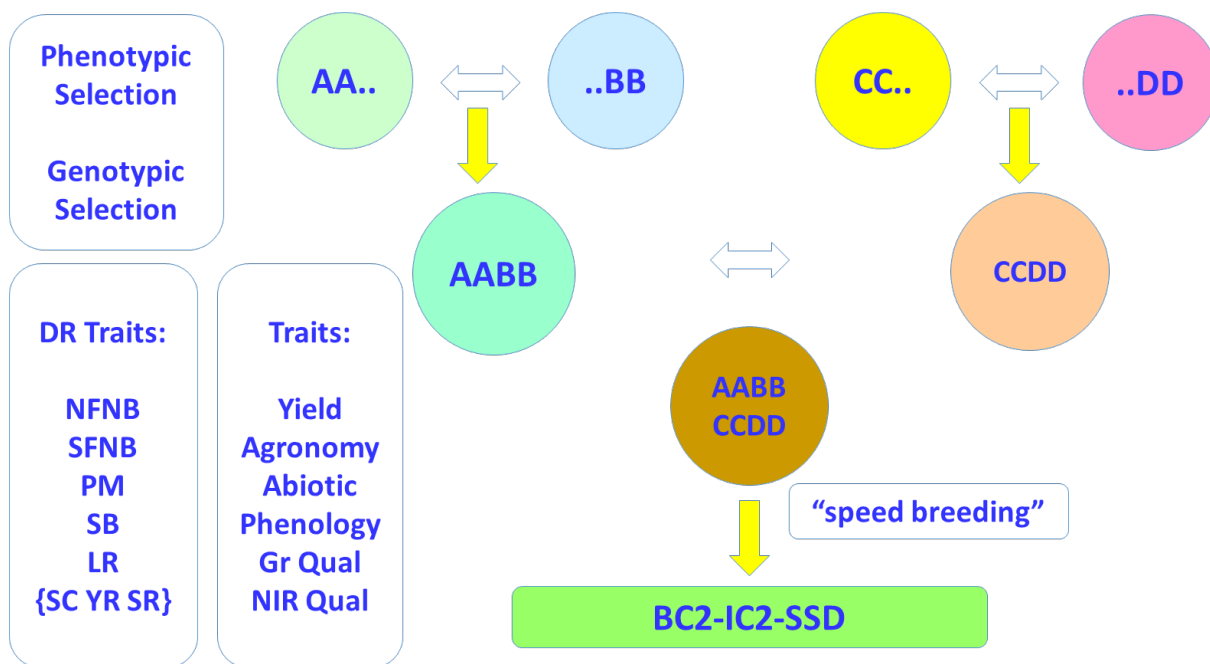


Figure 4: Male Sterile Facilitated Recurrent Selection (MSFRS) for Disease Resistance. A simplified schematic representation of the use of MSFRS, Genotypic and Phenotypic selection to Pyramid multiple genes for disease resistance into various “recurrent” parent backgrounds.

### Conclusions

Barley breeding and genetics has changed significantly over the past forty years or more. Australian malting varieties have improved to the point where they are competitive in the international market place. The longer term future of the barley industry will need to be competitive in relation to other crops. The industry needs to improve the overall barley disease resistance status both; to protect the yield, agronomic and quality improvements achieved but also to reduce the costs of managing multiple disease susceptibilities.

### References

“One Man’s Life with Barley – The Memories and Observations of Harry V Harlan” (1882 – 1944) New York, Exposition Press [1957] online from University of Michigan

Dedication: Barley Genetics Newsletter Vol 6 (<https://wheat.pw.usda.gov/ggpages/bgn/6/6ded.html>)

Lance and Nilan (1980) Screening for Low Acid-Soluble beta-glucan Barleys. BARLEY GENETICS NEWSLETTER, VOL. 10, II. RESEARCH NOTES, p. 41

Schaller, C.W. et al. 1963. Sources of resistance to the yellow dwarf virus in barley. Crop Sci. 3:342-344.

Fowler Ryan (2018) PhD Thesis dissertation ""



## INDEPENDENT AUDITOR'S REPORT

### The Trustee for Farrer Memorial Research Scholarship Fund

To Members of the New South Wales Parliament

#### Opinion

I have audited the accompanying financial statements of The Trustee for Farrer Memorial Research Scholarship Fund (the Trust), which comprise the Statement of Comprehensive Income for the year ended 31 December 2018, the Statement of Financial Position as at 31 December 2018, the Statement of Changes in Equity and the Statement of Cash Flows for the year then ended, notes comprising a Summary of Significant Accounting Policies and other explanatory information.

In my opinion, the financial statements:

- give a true and fair view of the financial position of the Trust as at 31 December 2018, and of its financial performance and its cash flows for the year then ended in accordance with Australian Accounting Standards
- are in accordance with section 41B of the *Public Finance and Audit Act 1983* (PF&A Act) and the Public Finance and Audit Regulation 2015.

My opinion should be read in conjunction with the rest of this report.

#### Basis for Opinion

I conducted my audit in accordance with Australian Auditing Standards. My responsibilities under the standards are described in the 'Auditor's Responsibilities for the Audit of the Financial Statements' section of my report.

I am independent of the Trust in accordance with the requirements of the:

- Australian Auditing Standards
- Accounting Professional and Ethical Standards Board's APES 110 'Code of Ethics for Professional Accountants' (APES 110).

I have fulfilled my other ethical responsibilities in accordance with APES 110.

Parliament promotes independence by ensuring the Auditor-General and the Audit Office of New South Wales are not compromised in their roles by:

- providing that only Parliament, and not the executive government, can remove an Auditor-General
- mandating the Auditor-General as auditor of public sector agencies
- precluding the Auditor-General from providing non-audit services.

I believe the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

#### Other Information

Other information comprises the information included in the Trust's annual report for the year ended 31 December 2018, other than the financial statements and my Independent Auditor's Report thereon. The Trustees are responsible for the other information. At the date of this Independent Auditor's Report, the other information I have received comprise the Statement in accordance with Section 41C(1B) of *Public Finance and Audit Act 1983*.

My opinion on the financial statements does not cover the other information. Accordingly, I do not express any form of assurance conclusion on the other information.

In connection with my audit of the financial statements, my responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit, or otherwise appears to be materially misstated.

If, based on the work I have performed, I conclude there is a material misstatement of the other information, I must report that fact.

I have nothing to report in this regard.

## **The Trustees' Responsibilities for the Financial Statements**

The Trustees are responsible for the preparation and fair presentation of the financial statements in accordance with Australian Accounting Standards and the PF&A Act, and for such internal control as the Trustees determine is necessary to enable the preparation and fair presentation of the financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Trustees are responsible for assessing the Trust's ability to continue as a going concern, disclosing as applicable, matters related to going concern and using the going concern basis of accounting except where the Trust will be dissolved by an Act of Parliament or otherwise cease operations.

## **Auditor's Responsibilities for the Audit of the Financial Statements**

My objectives are to:

- obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error
- issue an Independent Auditor's Report including my opinion.

Reasonable assurance is a high level of assurance, but does not guarantee an audit conducted in accordance with Australian Auditing Standards will always detect material misstatements. Misstatements can arise from fraud or error. Misstatements are considered material if, individually or in aggregate, they could reasonably be expected to influence the economic decisions users take based on the financial statements.

A description of my responsibilities for the audit of the financial statements is located at the Auditing and Assurance Standards Board website at: [www.auasb.gov.au/auditors\\_responsibilities/ar4.pdf](http://www.auasb.gov.au/auditors_responsibilities/ar4.pdf). The description forms part of my auditor's report.

My opinion does *not* provide assurance:

- that the Trust carried out its activities effectively, efficiently and economically
- about the security and controls over the electronic publication of the audited financial statements on any website where they may be presented
- about any other information which may have been hyperlinked to/from the financial statements.



C J Giumelli  
Director, Financial Audit Services

21 May 2019  
SYDNEY

**THE TRUSTEE FOR FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND**

**STATEMENT IN ACCORDANCE WITH SECTION 41C(1B)  
OF PUBLIC FINANCE AND AUDIT ACT 1983**

Pursuant to Section 41C (1B) of the *Public Finance and Audit Act 1983* and in accordance with a resolution of the Trustees of the Farrer Memorial Research Scholarship Fund, we declare on behalf of the Trust that, in our opinion:

- (a) the accompanying financial statements have been prepared in accordance with applicable Australian Accounting Standards (which include Australian Accounting Interpretations), the provisions of the *Public Finance and Audit Act 1983*, and the applicable clauses of the *Public Finance and Audit Regulation 2015*.
- (b) the accompanying financial statements exhibit a true and fair view of the financial position and the financial performance of Farrer Memorial Research Scholarship Fund for the year ended 31 December 2018.
- (c) at the date of signing we are not aware of any circumstances that would render the financial statements misleading or inaccurate.



Scott Hansen - Chair

Dated

1.5.2019



Kate Lorimer-Ward - Trustee

Dated 1.5.2019

## Beginning of the Financial Statements

### THE TRUSTEE FOR FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND

#### STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 31 DECEMBER 2018

	Notes	2018 \$	2017 \$
<b>Expenses excluding losses</b>			
Operating expenses			
Employee related	2a	9,349	10,379
Other operating expenses	2b	8,655	32,589
<b>Total expenses excluding losses</b>		<b>18,004</b>	<b>42,968</b>
<b>Revenue</b>			
Investment revenue	3a	31,088	34,172
In kind contribution - Department of Industry	3b	16,849	17,729
<b>Total revenue</b>		<b>47,937</b>	<b>51,901</b>
Other Gains / (losses)	4	(37,223)	37,307
<b>Net Result</b>		<b>(7,290)</b>	<b>46,240</b>
<b>Total Comprehensive Income</b>		<b>(7,290)</b>	<b>46,240</b>

The accompanying notes form part of these financial statements

**THE TRUSTEE FOR FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND**

**STATEMENT OF FINANCIAL POSITION  
AS AT 31 DECEMBER 2018**

	Notes	2018 \$	2017 \$
<b>ASSETS</b>			
<b>Current Assets</b>			
Cash and cash equivalents	5	154,540	112,776
Receivables	6	8,308	21,585
Inventories	7	787	1,051
Other financial assets	8	68,703	66,993
<b>Total Current Assets</b>		<b>232,338</b>	<b>202,405</b>
<b>Non-Current Assets</b>			
Financial assets at fair value	9	444,281	481,504
<b>Total Non-Current Assets</b>		<b>444,281</b>	<b>481,504</b>
<b>Total Assets</b>		<b>676,619</b>	<b>683,909</b>
<b>Net Assets</b>			
		<b>676,619</b>	<b>683,909</b>
<b>EQUITY</b>			
Accumulated funds		676,619	683,909
<b>Total Equity</b>		<b>676,619</b>	<b>683,909</b>

The accompanying notes form part of these financial statements



**THE TRUSTEE FOR FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND**

**STATEMENT OF CHANGES IN EQUITY  
FOR THE YEAR ENDED 31 DECEMBER 2018**

	<b>Accumulated Funds</b>	<b>Total</b>
	<b>\$</b>	<b>\$</b>
<b>BALANCE AT 1 January 2018</b>	<b>683,909</b>	<b>683,909</b>
Net result for the year	(7,290)	(7,290)
<b>BALANCE AT 31 December 2018</b>	<b>676,619</b>	<b>676,619</b>
<b>BALANCE AT 1 January 2017</b>	<b>637,669</b>	<b>637,669</b>
Net result for the year	46,240	46,240
<b>BALANCE AT 31 December 2017</b>	<b>683,909</b>	<b>683,909</b>

The accompanying notes form part of these financial statements

THE TRUSTEE FOR FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND

STATEMENT OF CASH FLOWS  
FOR THE YEAR ENDED 31 DECEMBER 2018

	Notes	2018 \$	2017 \$
<b>CASH FLOWS FROM OPERATING ACTIVITIES</b>			
<b>Payments</b>			
Grants and subsidies		-	(17,700)
Other		(891)	(7,005)
<b>Total Payments</b>		<b>(891)</b>	<b>(24,705)</b>
<b>Receipts</b>			
Interest received		1,356	1,264
Dividends received		21,479	23,123
Capital returns		7	-
Franking Credits		19,813	4,822
<b>Total Receipts</b>		<b>42,655</b>	<b>29,209</b>
<b>NET CASH FLOWS FROM OPERATING ACTIVITIES</b>	11	<b>41,764</b>	<b>4,504</b>
<b>CASH FLOWS FROM INVESTING ACTIVITIES</b>			
Proceeds from sale of financial assets		-	39,600
<b>NET CASH FLOWS FROM INVESTING ACTIVITIES</b>		<b>-</b>	<b>39,600</b>
<b>NET INCREASE / (DECREASE) IN CASH</b>		<b>41,764</b>	<b>44,104</b>
Opening Cash and Cash Equivalents		112,776	68,672
<b>CLOSING CASH AND CASH EQUIVALENTS</b>	5	<b>154,540</b>	<b>112,776</b>

The accompanying notes form part of these financial statements

## 1. Summary of Significant Accounting Policies

### (a) Reporting Entity

The *Farrer Memorial Research Scholarship Fund Act 1930* permits the Trustees (the Trust) to use its earnings to assist study and research into agricultural problems, meet costs of the Farrer Memorial Oration and may provide an honorarium to the recipient of the Farrer Memorial Medal. The Trust is a not-for-profit entity as profit is not its principal objective and it has no cash generating units.

These financial statements for the year ended 31 December 2018 have been authorised for issue by the Chair of the Trust on the date the accompanying statement by the Chair of the Trust was signed.

### (b) Basis of Preparation

The Trust's financial statements are general purpose financial statements which have been prepared on an accrual basis and in accordance with:

- applicable Australian Accounting Standards (which include Australian Accounting Interpretations)
- the requirements of the *Public Finance and Audit Act 1983* and *Public Finance and Audit Regulation 2015*.

Property, plant and equipment, assets (or disposal groups) held for sale and financial assets at 'fair value through profit or loss' and available for sale are measured at fair value. Other financial statement items are prepared in accordance with the historical cost convention.

Judgements, key assumptions and estimations management has made are disclosed in the relevant notes to the financial statements.

All amounts are rounded to the nearest dollar and are expressed in Australian currency.

### (c) Statement of Compliance

The financial statements and notes comply with Australian Accounting Standards which include Australian Accounting Interpretations.

### (d) Accounting for the Goods and Services Tax (GST)

Income, expenses and assets are recognised net of the amount of GST, except that the:

- amount of GST incurred by the Trust as a purchaser that is not recoverable from the Australian Taxation Office is recognised as part of the cost of acquisition of an asset or as part of an item of expense and
- receivables and payables are stated with the amount of GST included.

The net amount of GST recoverable from or payable to the Australian Taxation Office is included as part of receivables or payables respectively.

Cash flows are included in the statement of cash flows on a gross basis. However, the GST components of cash flows arising from investing and financing activities which are recoverable from, or payable to, the Australian Taxation Office are classified as operating cash flows.

### (e) Comparative Information

Except when Australian Accounting Standard permits or requires otherwise, comparative information is presented in respect of the previous period for all amounts reported in the financial statements.

### (f) New Australian Accounting Standards issued and effective for the first time at 31 December 2018

The accounting policies applied in the preparation of these financial statements are consistent with those of the previous financial year unless otherwise stated. The following new and revised Accounting Standards were applicable for the first time for the 2018 financial year.

- **AASB 9 Financial Instruments (1 Jan 2018)**  
The entity has adopted *AASB 9 Financial Instruments* (AASB 9), which resulted in changes in accounting policies in respect of recognition, classification and measurement of financial assets and financial liabilities; derecognition of financial instruments; impairment of financial assets and hedge accounting. AASB 9 also significantly amends other standards dealing with financial instruments such as the revised *AASB 7 Financial Instruments: Disclosures* (AASB 7R). The entity applied AASB 9 retrospectively, but has not restated the comparative information which is reported under *AASB 139 Financial Instruments: Recognition and Measurement* (AASB 139). The classification and measurement requirements of AASB 9 did not have a significant impact to the entity. The entity continued measuring at fair value, all financial assets previously held at fair value under AASB 139.

## 1. Summary of Significant Accounting Policies

### (g) Changes in accounting policy, including new or revised Australian Accounting Standards

NSW Public sector entities are not permitted to early adopt new Australian Accounting Standards, unless Treasury determines otherwise.

The following new Australian Accounting Standards have been issued but are not yet effective. The Trust has not early adopted any of these new standards or amendments. When applied in future periods, they are not expected to have a material impact on the financial position or performance of the Trust.

- AASB 15 Revenue from Contracts with Customers (1 Jan 2019)
- AASB 16 Leases replaces AASB 117 (1 Jan 2019)
- AASB 2016-7 Amendments to Australian Accounting Standards – Deferral of AASB 15 for Not-for-Profit Entities (1 Jan 2019)
- AASB 2016-8 Amendments to Australian Accounting Standards – Australian Implementation Guidance for Not-for-Profit Entities (1 Jan 2019)
- AASB 1058 Income of Not-for-profit Entities (1 Jan 2019)
- AASB 2017-6 Amendments to Australian Accounting Standards – Prepayment Features with Negative Compensation (1 Jan 2019)

## 2. Expenses Excluding Losses

	2018	2017
	\$	\$
<b>(a) Employee related expenses</b>		
Personnel expenses	9,349	10,379
	<b>9,349</b>	<b>10,379</b>

### Recognition and Measurement

The Trust does not have any employees and receives administrative, secretarial support and operational assistance from Department of Industry. The Trust is not required to reimburse Department of Industry for personnel services.

### (b) Other operating expenses include the following:

Auditor's remuneration	7,500	7,350
Bank charges	-	33
Scholarships	-	17,700
Other operating expenses	1,155	7,506
	<b>8,655</b>	<b>32,589</b>

### Recognition and Measurement

#### Insurance

The Trust's insurance activities are covered by Department of Industry insurance with the NSW Treasury Managed Fund Scheme of self-insurance for Government agencies.

## 3. Revenue

### Recognition and Measurement

Income is measured at the fair value of the consideration or contribution received or receivable. Comments regarding the accounting policies for the recognition of income are discussed below.

### (a) Investment revenue

Interest	3,098	2,967
Dividends	21,691	22,156
Franking Credits	6,292	5,617
Gain on sale of investment	7	3,432
	<b>31,088</b>	<b>34,172</b>

### Recognition and Measurement

#### Interest Income

Interest income is recognised using the effective interest rate method. The effective interest rate is the rate that exactly discounts the estimated future cash receipts over the expected life of the financial instrument or a shorter period, where appropriate, to the net carrying amount of the financial asset.

#### Dividend Income

Dividend income is recognised when the entity's right to receive payment has been established.

### (b) In kind contribution - NSW Department of Industry

Personnel services contribution	9,349	10,379
Audit fee contribution	7,500	7,350
	<b>16,849</b>	<b>17,729</b>

Department of Industry pays for audit remuneration and personnel service on behalf of the Trust. Department of Industry provides financial statement preparation services free of charge to the Trust.

### Recognition and Measurement

Contributions (including grants and donations) are generally recognised as income when the Trust obtains control over the assets comprising the contributions. Control over the contributions is normally obtained upon receipt of the cash.

Contributions are recognised at their fair value. Contributions of services are recognised when and only when a fair value of those services can be reliably determined and the services would be purchased if not donated.

**4. Other Gains / (Losses)**

	2018	2017
	\$	\$
Gains / (losses) on financial assets at fair value through profit or loss	(37,223)	37,307
	<b>(37,223)</b>	<b>37,307</b>

**5. Cash and Cash Equivalents**

Cash at bank and on hand	138,488	96,734
At call deposits	16,052	16,042
	<b>154,540</b>	<b>112,776</b>

For the purposes of the financial statement of cash flows, cash and cash equivalents include cash at bank, cash on hand, short-term deposits, at call deposits and bank overdraft.

Cash and cash equivalent assets recognised in the statement of financial position, are reconciled at the end of the financial year to the statement of cash flows as follows:

Cash and cash equivalents (per statement of financial position)	154,540	112,776
Closing cash and cash equivalents (per statement of cash flows)	<b>154,540</b>	<b>112,776</b>

Refer Note 12 for details regarding credit risk, liquidity risk and market risk arising from financial instruments.

**6. Current Assets - Receivables**

Receivables from investing activities	8,308	21,585
	<b>8,308</b>	<b>21,585</b>

Details regarding credit risk, liquidity risk and market risk, including financial assets that are either past due or impaired, are disclosed in Note 12.

**Recognition and Measurement**

Receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. These financial assets are recognised initially at fair value, usually based on the transaction cost or face value. Subsequent measurement is at amortised cost using the effective interest method, less an allowance for any impairment of receivables. Changes are recognised in the net result for the year when impaired, derecognised or through the amortisation process.

Short term receivables with no stated interest rate are measured at the original invoice amount where the effect of discounting is immaterial.

**7. Current Assets - Inventories**

Medals held for distribution - at cost	787	1,051
	<b>787</b>	<b>1,051</b>

Inventories consist of Farrer Memorial Medals. Medals are valued at cost which approximates fair value.

**Recognition and Measurement**

Inventories held for distribution are stated at cost, adjusted when applicable, for loss of service potential. A loss of service potential is identified and measured based on the existence of a current replacement cost that is lower than the carrying amount.

## 8. Current Assets - Other Financial Assets

	2018	2017
	\$	\$
Macquarie bank term deposit	68,703	66,993
	<b>68,703</b>	<b>66,993</b>

### Recognition and Measurement

All 'regular way' purchases or sales of other financial assets are recognised and derecognised on a trade date basis. Regular way purchases or sales are purchases or sales of other financial assets that require delivery of assets within the time frame established by regulation or convention in the marketplace.

Other financial assets are initially measured at fair value plus any transaction costs.

Refer to Note 12 for further information regarding credit risk, liquidity risk and market risk arising from financial instruments.

## 9. Non-Current Assets - Financial Assets at Fair Value

The following summary shows the market values (Fair value) of all shareholdings as at 31 December 2018.

Company	Market Value	
	2018	2017
	\$	\$
<b>Fixed Income Securities</b>		
National Australia Bank (NABHA)	30,895	29,082
Macquarie Bank (MBLHB)	30,780	29,700
Suncorp Group (SBKHB)	32,230	30,922
	<b>93,905</b>	<b>89,704</b>
<b>Listed Trusts</b>		
Dexus Property Group (DXS)	21,399	19,646
Goodman Group (GMG)	15,041	11,914
Sydney Airport (SYD)	68,646	71,910
Duet Group (DUE)	-	-
SP AusNet (AST)	22,548	26,173
	<b>127,634</b>	<b>129,643</b>
<b>Growth Securities (Shares)</b>		
National Australia Bank (NAB)	27,681	34,006
Clydesdale Bank (CYB)	956	1,662
Westpac Banking Corporation (WBC)	40,064	50,160
Coles Group (COL)	13,478	-
Cimic Group (CIM)	74,448	88,237
Wesfarmers (WES)	36,988	50,993
Telstra (TLS)	29,127	37,099
	<b>222,742</b>	<b>262,157</b>
<b>Portfolio Total</b>	<b>444,281</b>	<b>481,504</b>

The movement in the market value of the financial assets at fair value through the income statement in 2018 was a loss of \$37,223 (2017 gain of \$37,307).

Refer to Note 12 for further information regarding fair value measurement, credit risk, liquidity risk and market risk arising from financial instruments.

### Recognition and Measurement

All 'regular way' purchases or sales of financial assets are recognised and derecognised on a trade date basis. Regular way purchases or sales are purchases or sales of financial assets that require delivery of assets within the time frame established by regulation or convention in the marketplace.

### Financial assets at fair value through profit or loss

Financial assets at fair value through profit or loss include financial assets held for trading, financial assets designated upon initial recognition at fair value through profit or loss, or financial assets mandatorily required to be measured at fair value under AASB 9. Financial assets at fair value through profit or loss are initially and subsequently measured at fair value. Gains or losses on these assets are recognised in the net result for the year.

**9. Non-Current Assets - Financial Assets at Fair Value (continued)**

Purchases or sales of investments under contract that require delivery of the asset within a timeframe established by convention or regulation are recognised on the trade date; i.e. the date the Trust commits to the purchase or sale of the asset.

The fair value of investments that are traded at fair value in an active market is determined by reference to quoted current bid prices at the close of business on the statement of financial position date.

**10. Equity**

**Recognition and Measurement**

***Accumulated Funds***

The category accumulated funds includes all current and prior period retained funds.

**11. Reconciliation of Cash Flows from Operating Activities to Net Result**

	2018	2017
	\$	\$
<b>Net cash used on operating activities</b>	<b>41,764</b>	<b>4,504</b>
Increase/(decrease) in inventories	(264)	(528)
Increase/(decrease) in receivables	(13,277)	(1,077)
Increase/(decrease) in fair value of financial assets	(37,223)	37,307
Increase/(decrease) in other financial assets	1,710	2,602
Net gain/(loss) on sale of financial assets	-	3,432
<b>Net result</b>	<b>(7,290)</b>	<b>46,240</b>



## 12. Financial Instruments

The Trust's principal financial instruments are outlined below. These financial instruments arise directly from the Trust's operations or are required to finance the Trust's operations. The Trust does not enter into or trade financial instruments, including derivative financial instruments, for speculative purposes.

The Trust's main risks arising from financial instruments are outlined below, together with the Trust's objectives, policies and processes for measuring and managing risk. Further quantitative and qualitative disclosures are included throughout this financial statement.

The Trustees have overall responsibility for the establishment and oversight of risk management and reviews and agrees policies for managing each of these risks. Risk management policies are established to identify and analyse the risks faced by the Trust, to set risk limits and controls and to monitor risks.

The Trust's overall risk management program focuses on the risk versus return feature of financial markets and seeks to minimise adverse effects on the Trust's investment returns. The Trust currently does not use derivative instruments such as foreign exchange contracts and interest swaps to hedge its risk exposure. The Trust uses a variety of risk mitigation measures to manage the types of risk to which it is exposed. These methods include sensitivity analysis in the case of interest rates and other price risks.

The Trust maintains a number of investment portfolios to address a variety of objectives:

- A long term growth portfolio representing the Trust's asset reserves and endowments and has a long term investment horizon. This portfolio has an investment profile oriented towards growth assets and is managed by external fund managers.
- A long term debt portfolio used to generate a fixed income stream. This portfolio invests in short to medium term fixed and floating rate securities.

### (a) Financial Instrument Categories

#### i. As at 31 December 2018 under AASB 9

Financial Assets	Note	Category	Carrying Amount
<b>Class:</b>			<b>2018</b>
			\$
Cash and cash equivalents	5	N/A	154,540
Financial assets at fair value	9	At fair value through profit or loss - designated as such upon initial recognition	444,281
Receivables	6	Loans and receivables (at amortised cost)	8,308
Other financial assets	8	At fair value through profit or loss - designated as such upon initial recognition	68,703

#### ii. As at 31 December 2017 under AASB 139

Financial Assets	Note	Category	Carrying Amount
<b>Class:</b>			<b>2017</b>
			\$
Cash and cash equivalents	5	N/A	112,776
Financial assets at fair value	9	At fair value through profit or loss - designated as such upon initial recognition	481,504
Receivables	6	Loans and receivables (at amortised cost)	21,585
Other financial assets	8	Held to maturity (at amortised cost)	66,993

## 12. Financial Instruments (continued)

### (b) Credit Risk

Credit risk arises when there is the possibility that the counter party will default on their contractual obligations, resulting in a financial loss to the Trust. The maximum exposure to credit risk is generally represented by the carrying amount of the financial assets.

Credit risk arises from the financial assets of the Trust, including cash, receivables and other financial assets. No collateral is held by the Trust. The Trust has not granted any financial guarantees.

Credit risk associated with the Trust's financial assets, other than receivables, is managed through the selection of counter parties and establishment of minimum credit rating standards.

#### Cash

Cash comprises cash on hand and bank balances with St George Bank and Rabobank Australia Limited. St George interest is earned on the daily bank balance at market rates and Rabobank interest is earned at a flat 0.05% rate during 2018 (2017 0.05%).

#### Receivables - trade debtors

All trade debtors are recognised as amounts receivable at balance date.

#### Other financial assets

The Trust has placed funds on deposit with Macquarie Bank Limited for a fixed term. The interest rate payable is fixed for the term of the deposit. The deposits at balance date were earning an average interest rate of 2.75% (2017: 2.45%).

### (c) Liquidity risk

Liquidity risk is the risk that the Trust will be unable to meet its payment obligations when they fall due. The Trust continuously manages risk through monitoring future cash flows and maturities planning to ensure adequate holding of high quality liquid assets. The trust has no loans payable and no assets have been pledged as collateral. The Trust's exposure to liquidity risk is deemed insignificant based on prior periods' data and current assessment of risk. The Trust has no liabilities and the majority of the assets are cash, cash equivalents or tradable shares and securities.

### (d) Market risk

Market risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices. The Trust's exposure to market risk are primarily through price risk and cash flow and fair interest rate risk.

The effect on profit and equity due to a reasonably possible change in risk variable is outlined in the information below, for interest rate risk and other price risk.

#### Interest rate risk

The Trust's interest rate risk arises from the cash kept in the bank account subject to interest bearing at variable average rate of 0.25%. At 31 December 2018, if interest rates decreased/increased by 1.00% with all other variables held constant, equity would have been \$1,545 lower/higher (2017: \$1,128 lower/higher) as a result of an increase/decrease in fair value of debt security.

#### Other price risk

The Trust has exposure to equity securities price risk. This arises from investments held by the Trust and classified on the balance sheet as "Assets held at fair value" through the income statement, such that the impact of a change in value of the securities would be reflected as either an increase or decrease in fair value of the security through the income statement.

To manage its price risk from investments in equity securities, the Trust has contracted out the management of the portfolio to external fund managers, Macquarie Equities Limited. These fund managers are mandated to diversify the investments of the portfolio under their management. The quantum of funds under management per external fund manager and the investment objectives of each external fund manager are in accordance with policies set by the Trustees.

A majority of the Trust's equity investments managed by external fund managers are denominated in AUD, are publicly traded and included in the ASX 300 Index. The impact of increases/decreases on the ASX 300 Index on the Trust's equity would be increase/decrease of \$44,428 (2017: \$48,150). The analysis is based on the assumption that the ASX 300 Index increased/decreased by 10%, with all other variables held constant and the Trust's equity portfolio moves according to the historical correlation with the index.

## 12. Financial Instruments (continued)

### (d) Market risk (continued)

	Carrying Amount \$	Interest rate risk				Other price risk			
		-1.00%		1.00%		-10.00%		10.00%	
		Profit	Equity	Profit	Equity	Profit	Equity	Profit	Equity
<b>31 December 2018</b>									
<b>Financial Assets</b>									
Cash & cash equivalents	154,540	(1,545)	(1,545)	1,545	1,545	-	-	-	-
Financial Assets held to Maturity <sup>(1)</sup>	68,703	-	-	-	-	-	-	-	-
Receivables <sup>(2)</sup>	8,308	-	-	-	-	-	-	-	-
Fixed Income Securities <sup>(3)</sup>	93,905	-	-	-	-	(9,391)	(9,391)	9,391	9,391
Listed Trusts	127,634	-	-	-	-	(12,763)	(12,763)	12,763	12,763
Growth Securities	222,742	-	-	-	-	(22,274)	(22,274)	22,274	22,274
<b>Total increase/(decrease)</b>		<b>(1,545)</b>	<b>(1,545)</b>	<b>1,545</b>	<b>1,545</b>	<b>(44,428)</b>	<b>(44,428)</b>	<b>44,428</b>	<b>44,428</b>
<b>31 December 2017</b>									
<b>Financial Assets</b>									
Cash & cash equivalents	112,776	(1,128)	(1,128)	1,128	1,128	-	-	-	-
Financial Assets held to Maturity <sup>(1)</sup>	66,993	-	-	-	-	-	-	-	-
Receivables <sup>(2)</sup>	21,585	-	-	-	-	-	-	-	-
Fixed Income Securities <sup>(3)</sup>	89,704	-	-	-	-	(8,970)	(8,970)	8,970	8,970
Listed Trusts	129,643	-	-	-	-	(12,964)	(12,964)	12,964	12,964
Growth Securities	262,157	-	-	-	-	(26,216)	(26,216)	26,216	26,216
<b>Total increase/(decrease)</b>		<b>(1,128)</b>	<b>(1,128)</b>	<b>1,128</b>	<b>1,128</b>	<b>(48,150)</b>	<b>(48,150)</b>	<b>48,150</b>	<b>48,150</b>

*Notes:*

1. Held to Maturity Term Deposits are not traded and are not subject to interest rate variation during the term.
2. Receivables include interest due on Fixed Interest Securities and Term Deposits and dividends receivable. The value of these receivables will not change due to changes in market interest rates.
3. Fixed Income Securities are composed of Listed Fixed Interest Securities which are not subject to changes in market interest rates.

### (e) Fair value measurement

#### (i) Fair value compared to carrying amount

Financial instruments are generally recognised at cost, with the exception of investments, which are measured at fair value.

The carrying amount of the financial instruments recognised in the financial statements approximates the fair value.

#### (ii) Fair value recognised in the statement of financial position

When measuring fair value, the valuation technique used maximises the use of relevant observable inputs and minimises the use of unobservable inputs. Under AASB 13: Fair Value Measurement the Trust categorises, for disclosure purposes, the valuation techniques based on the inputs used in the valuation techniques as follows:

- Level 1 - quoted prices in active markets for identical assets/liabilities that the Trust can access at the measurement date.
- Level 2 - inputs other than quoted prices included in Level 1 that are observable, either directly or indirectly.
- Level 3 - inputs that are not based on observable market data (unobservable inputs).

The Trust recognises transfers between levels of the fair value hierarchy at the end of the reporting period during which the change has occurred.

## 12. Financial Instruments (continued)

### (e) Fair value measurement (continued)

#### (ii) Fair value recognised in the statement of financial position (continued)

	Level 1	Level 2	Level 3	2018
	\$	\$	\$	Total
	\$	\$	\$	\$
<b>Financial assets at fair value</b>				
Fixed Income Securities	93,905	-	-	93,905
Listed Trusts	127,634	-	-	127,634
Growth Securities	222,742	-	-	222,742
	<b>444,281</b>	<b>-</b>	<b>-</b>	<b>444,281</b>
	Level 1	Level 2	Level 3	2017
	\$	\$	\$	Total
	\$	\$	\$	\$
<b>Financial assets at fair value</b>				
Fixed Income Securities	89,704	-	-	89,704
Listed Trusts	129,643	-	-	129,643
Growth Securities	262,157	-	-	262,157
	<b>481,504</b>	<b>-</b>	<b>-</b>	<b>481,504</b>

There were no transfers between Level 1 or 2 during the period.

## 13. Related Parties

During the year, the Trust incurred \$4,985 (2017: \$4,886) in respect of the key management personnel services that were provided by a separate management entity, Department of Industry. All other services received from the Department of Industry were free of charge.

During the year, the Trust did not enter into any transactions with key management personnel, their close family members and/or controlled and jointly controlled entities thereof.

During the year, the Trust entered into transactions with other entities that are controlled / jointly controlled / significantly influenced by NSW Government. These transactions (incurred in the normal course of business) in aggregate are a significant portion of the Trust's revenue and expenses, and the nature of these significant transactions are detailed below:

Entity	Nature of Transactions
Audit Office of NSW	Provides independent audit services on the Trust's financial statements.
Department of Industry	Provision of administrative, secretarial support and operational assistance.

## 14. Commitments for Expenditure

The Trust has no commitments for expenditure as at 31 December 2018.

## 15. Contingent Assets and Liabilities

The Trust has no contingent assets or liabilities as at 31 December 2018.

## 16. After Balance Date Events

The Trust is unaware of any significant events after balance date that would impact the financial statements and the notes to the financial statements.

**END OF FINANCIAL STATEMENTS**

