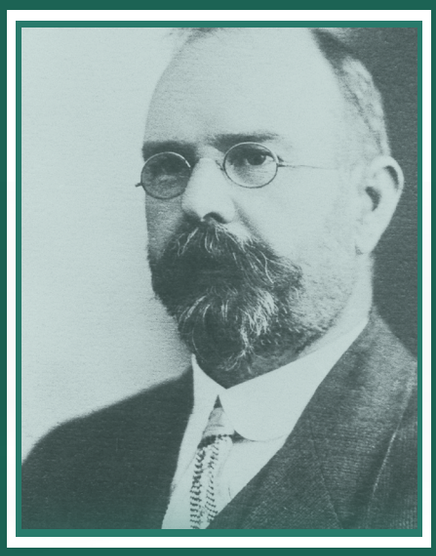


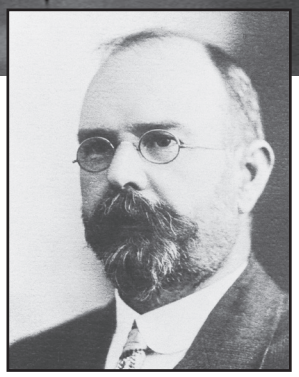
FARRER MEMORIAL TRUST

ANNUAL REPORT 2017

FARRER MEMORIAL RESEARCH SCHOLARSHIP FUND

THE 2017 FARRER MEMORIAL ORATION

FARRER MEMORIAL TRUST



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 Mr M Bullen, 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 2017 Farrer Memorial Travelling Scholarships were awarded to:

- Mr Samir Alahmad, University of Queensland
- Mr James Cowley, University of Adelaide
- Mr Arjun Pandey, University of Melbourne
- Ms Candy Taylor, University of Western Australia

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.

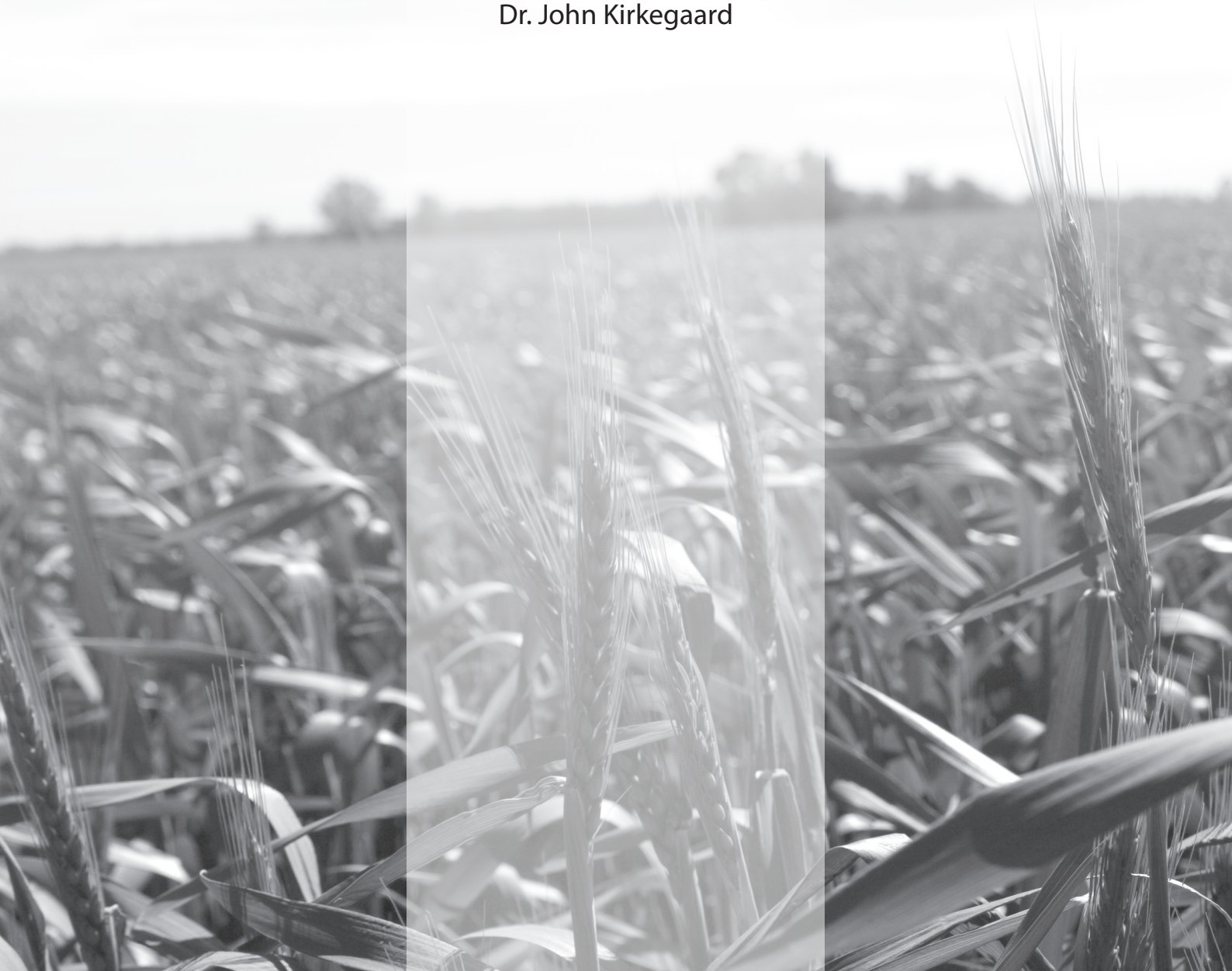
The 2017 Farrer Memorial Medal was awarded to Dr John Kirkegaard at the CSIRO Discovery Centre on Wednesday 22 November 2017. Dr Kirkegaard delivered the Farrer Oration entitled 'Farming Systems Agronomy - it is rocket science'

The text of the 2017 Farrer Memorial Oration is reproduced on page 3 of this report.

The 2017 Farrer Memorial Oration

FARMING SYSTEMS AGRONOMY: IT IS ROCKET SCIENCE

Dr. John Kirkegaard



Summary

Those not immediately involved in managing a dryland farm sustainably in a risky water-limited environment such as Australia may think a comparison with rocket science a bit of a stretch. But if the level of challenge, the importance to humanity, the long-term multidisciplinary team approach and planning required, and the level of uncertainty inherent in the pursuit are measures, then I think the comparison is warranted.

The importance of the farming systems research that has supported agriculture and food security in Australia and globally since Farrer's time perhaps receives less public attention than some other science areas such as genetics, genomics or digital agriculture – indeed agriculture is now literally "rocket science" as satellite-guided machines and sensors gather volumes of data about the soils, plants and weather on farms at scales and speeds hitherto impossible. Yet despite spectacular advances in individual genetic or management technologies, few have been singularly transformational. Rather significant productivity improvements generally arise when a combination of technologies, often old and new are integrated in specific ways within a system.

William Farrer himself was clearly aware of this fact, as we shall see later, and he placed as much importance on maintaining the fertility of the soil in which he grew wheat as on improving the wheat plant itself. In my Oration, I would like to first provide some background to Farrer, to his influence on my own family's fortunes, and on his interests in genotype x environment x management (G x E x M) interactions (though he certainly didn't use that terminology). I will then describe some examples from my own research teams, to demonstrate the ongoing impact that arises from research to capture synergies from new genetics and improved management.

William Farrer

I have enjoyed the opportunity through this award to become more familiar with the achievements of William Farrer, and I direct those seeking interesting yet accessible understanding of his work to the publication of his collaborator FB Guthrie (1922), and the interesting summaries contained within previous Orations such as that by LT Evans (1980) and many others found on the Farrer website at https://www.dpi.nsw.gov.au/about-us/who-we-are/interacting/farrer-memorial-trust/farrer-memorial-trust-medal-recipients-and-orations. More complete and comprehensive biographies are of course also available (e.g. Russell 1949).

Farrer was born in England and sailed to Australia in 1870 with the intention to buy a sheep property, but through various circumstances found himself instead working as a surveyor in central and southern NSW from 1875 to 1886. It was clear in his notes and writings that he had developed an interest in wheat from as early as 1882, and by 1886 he was in a financial and personal position to settle on the farm at Lambrigg near present-day Canberra with his wife Nina, and to intensify his passion and his hobby in wheat breeding and selection "to improve the constitutional fitness for the locality". At Lambrigg on his 3 acres of experimental plots (one half of which he rotated in alternate years), he embarked upon what was to be 20 years of work (until his death in 1906) that was to transform wheat production in Australia.

During that period Farrer was in constant contact with wheat breeders, growers and experiment stations in Australia and overseas and in 1898 accepted a position as wheat experimentalist with the NSW Department of Agriculture and Mines that allowed him to expand his testing environments. By making crosses and selections from Indian, Canadian and improved Fife wheats he was able to combine earlier maturity, improved disease resistance (and escape) along with better milling quality. Most of his improved varieties including Federation were made available to farmers during 1901-1903, and he was certainly able to see of some the success of his efforts prior to his death in 1906. Wheat production quadrupled in NSW in the 15 years from 1900 to 1915, and by that time 22 of the 29 varieties grown in that State were Farrer's (Wrigley 1981). His variety Federation which helped to open up much of the drier western area to wheat production was the leading wheat in Australia from 1910 to 1925. These impressive national statistics can sometimes mask the impact Farrer had on the lives of individual farming families, such as my own Danish immigrant family on the Darling Downs in Queensland.

A personal debt of gratitude

Not long after Farrer set sail for Australia, my own great-great-grandfather, J.A.C. Kirkegaard left western Jutland in Denmark with his family in 1872 and purchased a portion of Glengallan Station on Freestone Creek near Warwick, where he farmed on "Marydale" until his retirement in 1892. His own fortunes were therefore not touched to any extent by Farrer's work, but those of his youngest son, B.C.C. Kirkegaard who took over the farm in 1892 and farmed

until his retirement in 1936 were significantly so. As well as a wheat farmer (over 100 acres of his 234 acre holding was sown to wheat), B.C.C. Kirkegaard was a lifelong member of the Warwick Farmers Milling Association (from 1891 to 1941) and a founding member of the Queensland Wheat Board (member for 14 years from 1920). The impact of Farrer's earlier maturing, disease resistant and higher milling quality wheats must have certainly had an enormous impact on his farming fortunes, and as a consequence, on my own family. The variety Florence bred specifically for smut resistance, but which was also early maturing and suited to the Queensland environment was considered to underpin Queensland's success in wheat production in the 1920's (Guthrie 1922) and was still the 2nd leading wheat in 1938 (Wrigley 1981). The quality of Florence was so superior that a separate category has to be established for it for wheat quality prizes at the Sydney show. In trial results from Tamworth published in the Sydney Morning Herald in December 1930 (accessed on Trove, National Library of Australia), Florence yielded twice that of Federation (2.4 vs 1.1 t/ha) demonstrating its superiority in more northern environments at that time.

It is clear that this Farrer wheat variety, and no doubt others such as Flora that followed, underpinned the industry in the early decades of the century in Queensland. As a farmer, a miller and a member of the Queensland Wheat Board, Farrer's personal impact on my great-grandfather's career and his business success must have been immense. Impressive as Farrer's national (and international) achievements are, they can mask these impacts he had at this more individual (and personal) level, on the lives of so many individual immigrant and resident farmers as they opened up new lands to wheat farming in the more marginal areas of Australia. Though widely lauded for these breeding efforts, Farrer's interests and insights also extended beyond breeding and selection.

Farrer and agronomy – an early "G x E x M" advocate

In 1873 Farrer published a pamphlet entitled Grass and Sheep Farming, and though his continuing interests became focussed on wheat growing and the unsuitability of the existing wheat types sown, he was also aware of the importance of maintaining the fertility of the soil in which wheat was grown. In his letter of acceptance for the position of wheat experimentalist in 1898, in which he set out his manifesto of work, he wrote:

*"In addition to i**mprovements in the wheat plant** itself it is <u>of even greater importance</u> that I should conduct experiments to ascertain the **methods of soil management** which are the **most suitable for our climate**, and the conditions under which our **wheat growers** are working"*

William Farrer 1898

The bold and underlined text are mine, however though Farrer would not have used the term "G x E x M", he demonstrates a clear understanding that to improve wheat productivity in farmer's fields one must be simultaneously aware of the management systems (M) in which the new varieties (G) are expected to perform, as well as the environment (E) and other limitations that may face farmers themselves in combining those technologies.

Farrer had interests in pasture agronomy, green manuring, the development of alternatives to fallowing and in humus and nitrogen fixation by legumes. He was instrumental in setting up long-term soil fertility experiments at Wagga Wagga as a compliment to those in Rothamsted and was disappointed when they were discontinued (Evans 1980). Farrer's interests extended even further beyond the farm gate and included the interests of the whole "value-chain" (another term he would not have used) including market, miller, baker, exporter and consumer. In my Oration I will remain focussed on the farming systems aspects of his work, and will emphasise the ongoing importance of the G x E x M thinking that Farrer captured so elegantly above in his thinking more than a century ago.

How revolutions really happen in agriculture

The global food security challenge has prompted many to propose the need for "transformational change" in food production systems through technological "breakthroughs". These transformative technologies are often distinguished from the "incremental" advances generated by agronomy and breeding which are dismissed as business as usual, and inadequate to achieve the productivity improvements sought. The urgency for transformative change has been heightened by the reported (though contested) of a slowing in the productivity trends of major food crops, as well as declining or expensive resources of land, water and nutrients and predicted climate change (Fischer et al, 2014). At face value, it may seem trite to be critical of aspirations to achieve such breakthroughs, but in a world of diminishing expenditure in agricultural research it will be important to target dwindling R&D dollars well. Proposed transformative change often focus on one component of a system – a

new genetically modified crop; a more effective biological fertiliser; a new satellite-guided planter - often by largely disconnected research disciplines. In reality, and throughout history, few individual technologies have been singularly transformational either in the scale or the speed with which they have influenced productivity. Rather, step changes in productivity have come only when combinations of technologies, often a mix of old and new, synergise within a system. Lloyd Evans (1998) in his wonderful book "Feeding the Ten Billion" points out that the first agricultural revolution arose from a combination of pre-existing, individual technologies most of which were centuries old, but it was the combination that made them so effective:

*"individual components of the revolution had a long history but the **synergistic interactions** in the Norfolk system made it such an effective agent of improvement"*

The **Norfolk** system (Young 1771)

1. enclosures without Government assistance
2. use of marl (lime) and clay (known to Romans)
3. rotation of crops (Ancient Greeks)
4. turnips, hand hoed (in rows) (Chinese in 6th century)
5. culture of clover and rye (Ancient Greeks)
6. long leases, large farms

A more recent example of major productivity gains arising from such synergies is the high input hybrid maize systems in the USA (Duvick et al, 2005) in which maize hybrids adapted to high density protected by genetic tolerance to soil and insect pests and with cold soil tolerance can be sown earlier and at high density to capture the physiological benefits related to improved biomass production and conversion to grain.

Improved precision seeding technologies and protection with new fungicides and herbicides have assisted to progressively transform productivity (Figure 1) – in a process I describe as "incremental transformation".

In Australia, similar examples of these synergies can be found throughout the history of wheat production - from the time that Farrer first transformed productivity with better adapted varieties aided by the advent of super-phosphate, to the step changes offered by semi-dwarf wheat varieties with appropriate nitrogen supply and disease management (Donald 1965, Fischer 2007, Kirkegaard et al, 2014). My own career with CSIRO commenced in 1990 within a multi-disciplinary team within the Land and Water Care Project, focussed on improving the sustainability of dryland cropping in southern Australia through promotion of the "3R's" better Rotation, Reduced tillage and Retained stubble. I will describe some of the recent examples of the incremental transformation that my own colleagues and collaborators have been involved with that to me exemplify the success and impact that can be achieved by multi-disciplinary teams who adopt a G x E x M framework in pursuit of increased productivity.

A more recent revolution

The recent evolution of southern Australian dryland farming systems was comprehensively reviewed by Kirkegaard et al, (2011) but the changes in southern NSW systems during the 1980s and 1990s are worth briefly describing as a background to more recent innovations. Until the 1980s, the area grew mainly cereals (mostly wheat) in rotation with annual grass–subterranean clover pastures and fallow, with some areas of early-sown oats for sheep.

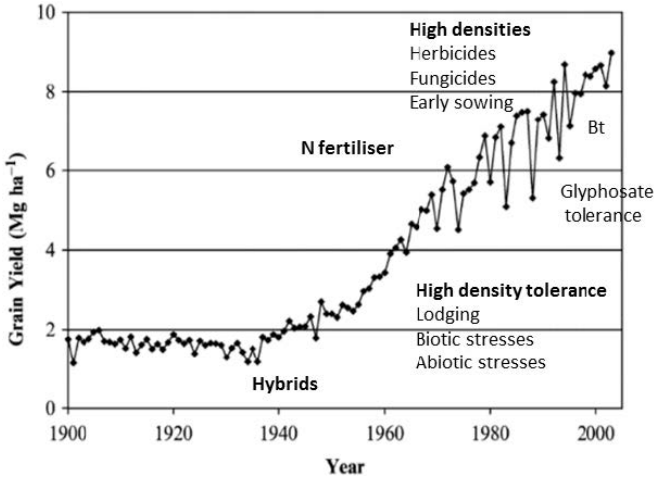


Figure 1. The combination of genetic and management factors underlying the increase in US maize yield (from Duvick 2005). Duvick commented that "the two tools interact so closely that neither of them could have produced such progress alone".

Grain legumes (lupin and pea) remained a relatively low proportion of the cropping systems throughout the 1980s and 1990's while canola (Brassica napus) became a significant component of the cropping system during the 1990s (Kirkegaard et al, 2016) after better adapted varieties with high yield, good quality (i.e. "double low", glucosinolate and erucic acid) and that were resistant to the main disease Blackleg (Leptosphaera maculans) were developed and released.

Canola was an acid sensitive crop and so was usually only grown on the acid soils in the area following an application of lime. Canola reduced the cereal root diseases that had been rife

in the grassy pasture-wheat-barley systems, and as a consequence responses to tactical N fertiliser application were observed for the first time in the newly responsive, disease-free wheat crops (Angus 2001). This combination of limed canola, and N-fertilised wheat saw significant improvements in average crop yield throughout the 1990s (Angus 2001), and lifted the yield of the semi-dwarf wheats closer to their unfulfilled potential (Cornish and Murray 1989). Liming also improved the establishment and persistence of lucerne which contributed greatly to the annual clover-based pasture production in the area on what were largely until then mixed farming systems. The system of lucerne-based pastures phased with sequences of mostly wheat and canola crops fertilised with tactical N application and lime was a highly productive system throughout the 1990s with echoes of the same individual components that combined in the first agricultural revolution described above. Since then the Millenium drought (2002 to 2010) and the prospects of hotter and drier springs, and a more extreme and variable climate has led to ongoing evolution of the farming system. There has been a strong focus on genetic and management strategies that capture, store and use rainfall more efficiently, while protecting the resource base and maintaining business profit.

Canola – an exceptional crop for Australia

Canola production in Australia has increased 10-fold since 1993 from 0.3 to 4.0 Mt and it is now Australia's 3rd most important food crop after wheat and barley. It's development and expansion relied on talented breeders and agronomists targeting similar issues as Farrer did in wheat – adaptation to the environment with improved phenology, resistance to the devastating disease Blackleg (Leptosphaeria maculans) and improved oil quality (Kirkegaard et al, 2016), requiring a combination of European, Canadian and Japanese ancestry. In fact the original ARAB (Australian Research Agronomists and Breeders) group that met in 1977 was rooted firmly in the philosophy of shared knowledge and genotype and management interactions to underpin productivity increases (Buzza 2007).

The important rotational benefits in southern NSW described above and attributed mostly to cereal root disease control continue (Angus et al, 2015), although in contemporary systems it is herbicide-resistant weed control that has become a greater focus of canola's benefits in the farming system. Though rotational benefits drove initial adoption it has been important to continually increase the productivity and profitability of the canola crop itself. A first step, as in wheat, was to benchmark performance against a defensible estimate of yield potential. Robertson and Kirkegaard (2005) used an expected seasonal water-use efficiency approach to establish and upper boundary of 15 kg/ha.mm above an estimated evaporative loss of 100mm in southern NSW to investigate canola performance. Simulation approaches have also been used to account more fully for crop, soil, climate and management impacts on yield potential. The latter approach suggested current yields in farmer's fields may only be 42 to 68% of potential, an observation supported by the yields achieved in well-managed National Variety Testing experiments (Kirkegaard et al, 2016). Two recent GxExM approaches to increase productivity and profitability of canola are worthy of mention here.

Earlier-sown canola – a GxExM challenge

Canola has traditionally been sown from ANZAC Day (25 April) in much of southern Australia, and the importance of timely sowing is well known. However, larger farms, changes in autumn rainfall and improved seeding technologies have seen a trend towards even earlier sowing in early to mid-April (Kirkegaard et al, 2016). However current fast-spring canola varieties without vernalisation and adapted to late-April and May sowing flower too early from earlier sowing dates which limits biomass production and yield potential and exposes the crop to increased frost risk. Since 2014 we have been evaluating the potential to move to earlier sowing systems in canola by developing suitable GxExM combinations to capture the yield, oil and profit benefits made possible by the physiological benefits of early-sown crops. As a first step we identified the optimum flowering period for canola to maximise yield across variable seasons, and then identified sowing date and variety combinations that reliably flower in the optimum window.

Figure 2 shows how some varieties (e.g. Archer) with a vernalisation requirement retain a more stable flowering period from a range of sowing dates compared to existing spring varieties (e.g. Stingray) and stabilise yield accordingly.

Understanding the biomass required to achieve the estimated yield potential, and the cheapest way to achieve the required trajectory of biomass through the season by manipulating sowing time, variety type (e.g. hybrid), seeding rate and nitrogen management is the next step. Finally, understanding varietal traits and management strategies to achieve a more efficient conversion of biomass to grain crop may offer further avenues for improvement. In southern NSW, the shift towards aiming to finish sowing canola by ANZAC Day (rather than starting) has seen significant yield increases at the farm level. The agronomy required to capture the benefits of these systems include strict summer weed control, good residue management to facilitate ease of sowing and weed control, careful seed and fertiliser placement at sowing in rapidly drying soils and good early management on insects, weeds and diseases. New narrow-spectrum fungicide, herbicide and insecticide products are improving the success with early sowing.

Early-sown canola can be grazed

An additional advantage of early-sown crops on mixed farms is that the rapid early vegetative biomass production can provide grazing opportunities (Dove and Kirkegaard 2014). Dual-purpose canola provides an excellent break-crop for wheat in high rainfall zones where diseases and weeds can limit high value grazed cereals, and in the low rainfall zone can reduce the riskiness of canola by provided some upfront income to offset the cost of establishment. The development of dual-purpose canola was a truly interdisciplinary exercise that again required attention to selection of varieties with the right phenology and crop vigour, understanding interactions between grazing and disease (especially Blackleg) (Sprague et al, 2013), and the potential impacts of grazing on oil quality. In addition, animal grazing management to optimise both crop and animal production was essential (Bell et al., 2015). Newly developed herbicide and disease resistant, winter hybrid types have been released as dual-purpose grazing options in the medium and high rainfall zones of southern Australia and can achieve in excess of 2000 dse-grazing days and recover to yield up to 4 t/ha of high oil canola seed (Lilley et al, 2015). The rotational benefits flow to succeeding wheat crops in a crop sequence, and assist to control intractable grass weeds such as serrated tussock to allow successful establishment of perennial pastures. Careful grazing management linked to both crop phenological stage, and residual biomass allows grazing without a loss in seed yield potential

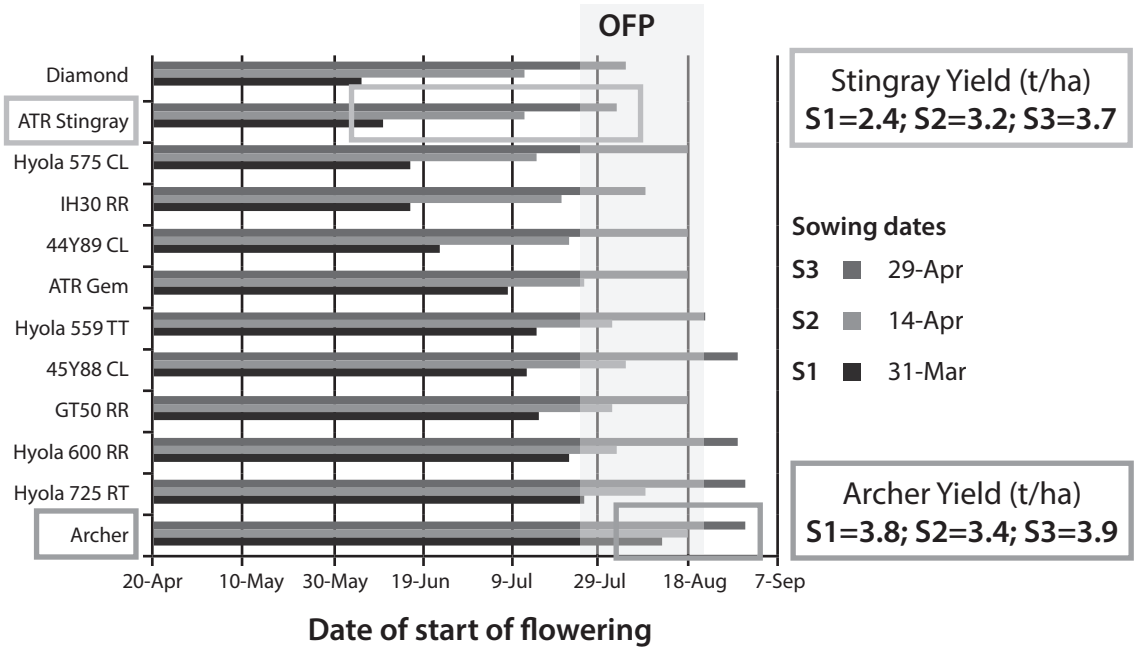


Figure 2. At Wagga Wagga in 2016, the slow spring variety Archer flowered in, or close to the optimum flowering period (OFP) from a wide sowing window with high and stable yield across the sowing dates. In contrast, fast spring varieties such as Stingray only flowered in the OFP from later sowing dates and were not suitable for earlier April sowing (Courtesy Rohan Brill, NSWDPI).

adding clear profit to the bottom line of mixed farming systems. The integration of dual-purpose wheat and canola into these traditional grazing systems has lifted farm profits by at least $100 per farm hectare and achieved increased animal and crop production from the same farm simultaneously.

It is perhaps not surprising that the issues William Farrer focussed on in wheat over 100 years ago – phenological adaptation, disease management and crop quality – have also dominated the research agenda in a relatively new crop such as canola, and require ongoing refinement in a G x E x M framework to capture the full benefits from innovative systems such as early-sown, grazed crops. It is perhaps more surprising that in wheat itself, significant productivity gains should still be emerging from manipulation of these same factors.

Improving farm-level water-use efficiency

In 2009, the Australian grains industry through the Grains Research and Development Corporation (GRDC) challenged growers and researchers to demonstrate how they could improve the water use efficiency (productivity per mm of rainfall) of their systems. A network of 17 existing regional grower groups were funded by the GRDC and co-ordinated by a CSIRO farming systems research team to provide an integrated and consistent approach to the work. Not surprisingly, the grower groups nominated numerous different ways in which they believed progress could be made. These were essentially collapsed into 4 linked themes of research for the 5-year program: (1) long-term soil management (2) improved crop sequence, (3) better summer fallow management, and (4) in-crop water-use patterns. Kirkegaard and Hunt (2010) demonstrated how these activities are all linked in terms of the water-use efficiency framework established earlier by Passioura (1977). They used simulation modelling of different management scenarios for wheat systems at Kerang in the Victorian Mallee to demonstrate that the largest benefits came when all of these approaches were simultaneously optimised, and that improving any one factor in isolation generated relatively small shifts in productivity from the 1.6 t/ha baseline (Table 1).

Interestingly the novel genetic trait, long coleoptiles that allow wheat to emerge from deeper sowing, and thus to be sown reliably on stored water in April, actually reduced yield if adopted without the rest of the agronomic package that provided the increased water capture and storage to capitalise on the higher yield. The subsequent 5-year, on-farm experimental program confirmed most of these predictions (Kirkegaard et al, 2014) with the combination of good rotation (to manage disease and weeds), weed and stubble management in the summer fallow (to preserve water and N), earlier sowing of appropriate varieties (to capitalise on the stored water and N to increase yield potential), and modified in-crop agronomy (to manage the balance of pre- and post-flowering water use) provided significant gains in productivity. Further analysis identified how earlier sowing in some paddocks generated flow-on effect across the farm allowing the sowing program in all paddocks to move into an earlier window with a multiplying effect across the farm. Until recently suitably adapted varieties with a phenology appropriate to earlier sowing have only been available as grazing options in some areas with no options in large parts of southern Australia. Hunt (2017) and Flohr et al., (2017) have recently demonstrated the potential of better adapted "fast winter" wheats across a broad range of sites in southern Australia with yields exceeding current spring or existing winter wheats by 8 to 18%. This research, greatly assisted by the knowledge of the underlying genetic

Table 1. Effect of individual management changes either singly, or when combined, on the mean yield of wheat at Kerang in the Victorian Mallee region when compared to the baseline yield of 1.6 t/ha (from Kirkegaard and Hunt 2010). The baseline scenario consisted of:

Burn/cultivate, grazed weedy fallow, continuous wheat, spring wheat sown after 25 May.

System change	Mean Yield (t/ha)	
	Single effect	Additive effect
1. No-till	1.84	1.84
2. Fallow weed control	2.37	2.80
3. Pea break crop	1.76	3.45
4. Sow earlier (from 25 April)	2.10	4.01
5. Long coleoptile wheat – sow on 25 April	1.45	4.54

control of crop phenology in wheat, and the availability of phenology isolines (Trevaskis 2010) has recently culminated the first commercial fast winter wheat variety widely adapted to southern Australian soils

(Longsword) released to growers in 2017. Farrer himself would possibly be amazed that such productive research on adapting wheat to the Australian environment continues to this day, although perhaps less so had he envisaged how climate and management technologies would shift across the same period.

Farrer's fight continues

Much of the yield benefits from early-sown canola and wheat crops can be traced to the improved access to deep water late in the season, afforded by the deeper root systems made possible by a longer vegetative phase (Kirkegaard et al., 2015). This raises the issue of legacy effects – in dryland environments how often can we expect that water to be there once it is used? (Kirkegaard and Ryan 2012). Lilley and Kirkegaard (2016) investigated that question at several sites across Australia and found that in lower rainfall areas, or on shallow soils, the yield benefits from deeper roots over a series of years are less, due to those legacy effects – in essence subsoil profiles often do not re-fill from season to season. However in medium and higher rainfall areas on deeper soil, such as those in southern NSW there appears to be considerable scope to use early sowing to capture water that is otherwise evaporated in summer and early autumn, or drains during the wet winter. A simulation study using data validated over 28 years at the CSIRO Harden long-term experiment demonstrates this potential (Table 2). We first validated the model against the actual data for the 28-year crop sequence where crops were generally sown in May, and then re-ran the model with scenarios in which the wheat (15 crops) and canola (5 crops) crops were sown earlier (according to actual sowing opportunity each year). We used appropriate varieties for the earlier sowing to maintain optimal flowering dates and investigated whether we achieved overall yield increases, or if the higher yielding crops simply "stole" water or N from subsequent crops and diminished the yield advantage. The simulation predicted an overall increase in wheat and canola yield is possible, but that the full extent of yield potential is not realised without a simultaneous increase in the nitrogen applied (in this case an extra 50 kg/ha to every crop). It seems fitting that here, as was predicted by Farrer in the cropping systems of his day, that the nitrogen nutrition of the crops should be such a key driver in realising the higher yield potential of the adapted wheat and canola varieties that are now available.

Conclusion

The exercise described in the previous section, as yet to be confirmed with data from experiments that are now underway, again highlights the need to be manipulating several management and genetic components simultaneously in order to reach the water-limited potential of the system. Were we to also consider the grazing potential of these new early-sown wheat and canola crops, and the increases in winter stocking rate for sheep made possible by the winter forage on-offer (at no cost to grain yield), the whole-farm profitability implications become even more profound. This recent shift in thinking from the focus on the productivity and water-use efficiency of individual wheat crops, to that of the whole farming system (Hochman et al., 2014), to me marks a paradigm shift into which individual disciplinary expertise must be coaxed. Farming systems agronomy provides such an integrative framework and its science should sit alongside the wonderful fundamental biology and engineering that underpins modern genetics and digital agriculture. Rocket science needs its "mission control" and agricultural science needs the context and integration provided by agronomists, farmers and their consultants in the journey from inspiration to impact.

Table 2. The predicted impacts of sequential changes to management on the long-term mean yield of wheat and canola at the CSIRO Harden long-term tillage site.

Crop	Baseline	Weed control	Weed control Early wheat	Weed control Early wheat Early canola	Weed control Early wheat Early canola + 50 kg N/ha/yr
Wheat	4.5	4.7	5.6	5.5	6.0
Canola	2.9	3.1	2.9	3.3	5.0

Acknowledgements

I would like to thank the Farrer Memorial Trust for the great honour of this award, for providing me the chance to reflect on the achievements of William Farrer, and in doing so to find such an interesting professional and personal connection to his work. The Theme of my Oration has been teams and interactions - and so collectively I would like to thank my colleagues and collaborators, mentors and managers, family and friends who have all contributed to the work discussed and sustained my energy and enthusiasm for our collective effort. I especially thank John Passioura, Tony Fischer, Mark Conyers and Mike Robertson for their stimulating contributions to the Program and wise council. Finally and most importantly, to my partner Julianne and my children Isabelle, Angela and Minette - I thank you all for your patience, tolerance and support of my passion for agriculture.

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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 financial position as at 31 December 2017, the statement of comprehensive income, statement of changes in equity and 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 2017 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 also fulfilled my other ethical responsibilities in accordance with APES 110.

The PF&A Act further 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, but precluding the provision of non-audit services.

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

Level 15, Margaret Street, Sydney NSW 2000 | GPO Box 12, Sydney NSW 2001 | t 02 9275 7101 | f 02 9275 7179 | email@audit.nsw.gov.au | audit.nsw.gov.au

The Trustees' Responsibility 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 Responsibility 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: http://www.auasb.gov.au/auditors_files/ar3.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

31 August 2018
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 2017.

(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 21/06/18

Kate Lorimer-Ward - Trustee
Dated 21/06/18

STATEMENT OF COMPREHENSIVE INCOME
FOR THE YEAR ENDED 31 DECEMBER 2017

	Notes	2017 $	2016 $
Expenses excluding losses			
Operating expenses			
Employee related	2a	10,379	11,333
Other operating expenses	2b	32,589	38,618
Total expenses excluding losses		**42,968**	**49,951**
Revenue			
Investment revenue	3a	71,479	54,473
In kind contribution - Department of Industry	3b	17,729	18,333
Total revenue		**89,208**	**72,806**
Net Result		**46,240**	**22,855**
Total Comprehensive Income		**46,240**	**22,855**

The accompanying notes form part of these financial statements

STATEMENT OF FINANCIAL POSITION
AS AT 31 DECEMBER 2017

	Notes	2017 $	2016 $
ASSETS			
Current Assets			
Cash and cash equivalents	4	112,776	68,672
Receivables	5	21,585	22,662
Inventories	6	1,051	1,579
Other financial assets	7	66,993	64,390
Total Current Assets		**202,405**	**157,303**
Non-Current Assets			
Financial assets at fair value	8	481,504	480,366
Total Non-Current Assets		**481,504**	**480,366**
Total Assets		**683,909**	**637,669**
Net Assets		**683,909**	**637,669**
EQUITY			
Accumulated funds		683,909	637,669
Total Equity		**683,909**	**637,669**

The accompanying notes form part of these financial statements

STATEMENT OF CHANGES IN EQUITY
FOR THE YEAR ENDED 31 DECEMBER 2017

	Accumulated Funds	Total
	$	$
BALANCE AT 1 January 2017	**637,669**	**637,669**
Net result for the year	46,240	46,240
BALANCE AT 31 December 2017	**683,909**	**683,909**
BALANCE AT 1 January 2016	**614,814**	**614,814**
Net result for the year	22,855	22,855
BALANCE AT 31 December 2016	**637,669**	**637,669**

The accompanying notes form part of these financial statements

STATEMENT OF CASH FLOWS
FOR THE YEAR ENDED 31 DECEMBER 2017

	Notes	2017 $	2016 $
CASH FLOWS FROM OPERATING ACTIVITIES			
Payments			
Grants and subsidies		(17,700)	(28,681)
Other		(7,005)	(2,672)
Total Payments		**(24,705)**	**(31,353)**
Receipts			
Interest received		1,264	1,279
Dividends received		23,123	28,892
Franking Credits		4,822	10,372
Total Receipts		**29,209**	**40,543**
NET CASH FLOWS FROM OPERATING ACTIVITIES	9	**4,504**	**9,190**
CASH FLOWS FROM INVESTING ACTIVITIES			
Proceeds from sale of financial assets		39,600	-
NET CASH FLOWS FROM INVESTING ACTIVITIES		**39,600**	**-**
NET INCREASE / (DECREASE) IN CASH		**44,104**	**9,190**
Opening Cash and Cash Equivalents		68,672	59,482
CLOSING CASH AND CASH EQUIVALENTS	4	**112,776**	**68,672**

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 2017 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) 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.

(e) 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.

(f) Income Recognition

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

(i) Contributions

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.

(ii) Investment revenue

Interest revenue is recognised using the effective interest method as set out in AASB 139: *Financial Instruments: Recognition and Measurement.* Dividend revenue is recognised in accordance with AASB 118: *Revenue* when the Trust's right to receive payment is established.

1. Summary of Significant Accounting Policies

(g) Personnel services

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.

(h) Assets

(i) Loans and Receivables

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. Any changes are accounted for 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.

(ii) Inventories

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.

(iii) Investments

Investments are initially recognised at fair value plus, in the case of investments not at fair value through profit or loss, transaction costs. The Trust determines the classification of its financial assets after initial recognition and, when allowed and appropriate, revaluates this at each financial year end.

- **Fair value through profit or loss -** The Trust subsequently measures investments classified as 'held for trading' or designated upon initial recognition 'at fair value through profit or loss' at fair value. Financial assets are classified as 'held for trading' if they are acquired for the purpose of selling in the near term. Derivatives are also classified as 'held for trading'. Gains or losses on these assets are recognised in the net result for the year.
- **Held-to-maturity investments -** Non-derivative financial assets with fixed or determinable payments and fixed maturity that the Trust has the positive intention and ability to hold to maturity are classified as 'held-to-maturity'. These investments are measured at amortised cost using the effective interest method. Changes are recognised in the net result for the year when impaired, derecognised or through amortisation process.
- **Available-for-sale investments -** Any residual investments that do not fall into any other category are accounted for as available-for-sale investments and measured at fair value. Gains or losses on available-for-sale investments are recognised in other comprehensive income until disposed or impaired, at which time the cumulative gain or loss previously recognised in other comprehensive income is recognised in the net result for the year. However, interest calculated using the effective interest method and dividends are recognised in the net result for the year.

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.

(i) Fair value hierarchy

A number of the Trust's accounting policies and disclosures require the measurement of fair values, for both financial and non-financial assets and liabilities. 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.

1. Summary of Significant Accounting Policies

(j) Equity

(i) Accumulated Funds
The category accumulated funds includes all current and prior period retained funds.

(k) 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.

(l) New Australian Accounting Standards issued and effective for the first time at 31 December 2017

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 2017 financial year. However, these standards do not have a material effect on the accounting policies adopted by the Trust.

- AASB 2015-6 Amendments to Australian Accounting Standards - Extending Related Party Disclosures to Not-for-Profit Public Sector Entities
- AASB 2015-7 Amendments to Australian Accounting Standards - Fair Value Disclosures of Not-for-Profit Public Sector Entities
- AASB 2016-2 Amendments to Australian Accounting Standards - Disclosure initiative: Amendments to AASB 107
- AASB 2016-4 Amendments to Australian Accounting Standards - Recoverable Amount of Non-Cash-Generating Specialised Assets of Not-for-Profit Entities

(m) 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.

Accordingly, the Trust has not applied the following Australian Accounting Standards recently issued but not yet implemented:

- AASB 9 and AASB 2014-7 regarding financial instruments (1 Jan 2018)
- AASB 15 and AASB 2014-5, AASB 2016-3 and AASB 2015-8 regarding Revenue from Contracts with Customers (1 Jan 2018)
- 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)

While the Impact of these standards in the period of initial application has not been specifically quantified, they are not expected to materially impact the financial statements.

2. Expenses Excluding Losses

		2017 $	2016 $
(a)	**Employee related expenses**		
	Personnel expenses	10,379	11,333
		10,379	**11,333**
(b)	**Other operating expenses include the following:**		
	Auditor's remuneration	7,350	7,000
	Bank charges	33	34
	Scholarships	17,700	28,681
	Other operating expenses	7,506	2,903
		32,589	**38,618**

3. Revenue

(a)	**Investment revenue**		
	Interest	2,967	3,135
	Dividends	22,156	22,889
	Franking Credits	5,617	5,660
	Gain on sale of investment	3,432	-
	Net fair value gains on measurement of investments in listed shares designated through profit and loss	37,307	22,789
		71,479	**54,473**
(b)	**In kind contribution - NSW Department of Industry**		
	Personnel services contribution	10,379	11,333
	Audit fee contribution	7,350	7,000
		17,729	**18,333**

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.

4. Cash and Cash Equivalents

	2017 $	2016 $
Cash at bank and on hand	96,734	52,636
At call deposits	16,042	16,036
	112,776	**68,672**

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)	112,776	68,672
Closing cash and cash equivalents (per statement of cash flows)	**112,776**	**68,672**

Refer Note 10 for details regarding credit risk, liquidity risk and market risk arising from financial instruments.

5. Current Assets - Receivables

	2017 $	2016 $
Receivables from investing activities	21,585	22,662
	21,585	**22,662**

Details regarding credit risk, liquidity risk and market risk, including financial assets that are either past due or impaired, are disclosed in Note 10.

6. Current Assets - Inventories

Medals held for distribution - at cost	1,051	1,579
	1,051	**1,579**

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

7. Current Assets - Other Financial Assets

Macquarie bank term deposit	66,993	64,390
	66,993	**64,390**

Refer to Note 10 for further information regarding credit risk, liquidity risk and market risk arising from financial instruments.

8. Non-Current Assets - Financial Assets at Fair Value

The following summary shows the market values (Fair value) of all shareholdings as at 31 December 2017.

Company	Market Value 2017 $	2016 $
Fixed Income Securities		
National Australia Bank (NABHA)	29,082	26,363
Macquarie Bank (MBLHB)	29,700	24,984
Suncorp Group (SBKHB)	30,922	30,135
	89,704	**81,482**
Listed Trusts		
Dexus Property Group (DXS)	19,646	19,384
Goodman Group (GMG)	11,914	10,089
Sydney Airport (SYD)	71,910	61,098
Duet Group (DUE)	-	36,168
SP AusNet (AST)	26,173	22,910
	129,643	**149,649**
Growth Securities (Shares)		
National Australia Bank (NAB)	34,006	35,271
Clydesdale Bank (CYB)	1,662	1,383
Westpac Banking Corporation (WBC)	50,160	52,160
Cimic Group (CIM)	88,237	59,922
Wesfarmers (WES)	50,993	48,377
Telstra (TLS)	37,099	52,122
	262,157	**249,235**
Portfolio Total	**481,504**	**480,366**

The movement in the market value of the financial assets at fair value through the income statement in 2017 was a gain of $37,307 (2016 gain of $22,789), less the decrease in portfolio value from the sale of Duet Group (DUE) shares.

Refer to Note 10 for further information regarding fair value measurement, credit risk, liquidity risk and market risk arising from financial instruments.

9. Reconciliation of Cash Flows from Operating Activities to Net Result

	2017 $	2016 $
Net cash used on operating activities	**4,504**	**9,190**
Increase/(decrease) in inventories	(528)	(264)
Increase/(decrease) in receivables	(1,077)	(9,814)
Increase/(decrease) in fair value of financial assets	37,307	22,790
Increase/(decrease) in other financial assets	2,602	953
Net gain/(loss) on sale of financial assets	3,432	-
Net result	**46,240**	**22,855**

10. 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

Financial Assets	Note	Category	Carrying Amount	Carrying Amount
Class:			**2017 $**	**2016 $**
Cash and cash equivalents	4	N/A	112,776	68,672
Financial assets at fair value	8	At fair value through profit or loss - designated as such upon initial recognition	481,504	480,366
Receivables	5	Loans and receivables (at amortised cost)	21,585	22,662
Other financial assets	7	Held to maturity (at amortised cost)	66,993	64,390

10. 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 2017 (2016 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 2.45% (2016: 2.80%).

(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 2017, if interest rates decreased/increased by 1.00% with all other variables held constant, equity would have been $1,128 lower/higher (2016: $687 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 $48,150 (2016: $48,037). 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.

10. 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
31 December 2017									
Financial Assets									
Cash & cash equivalents	112,776	(1,128)	(1,128)	1,128	1,128	-	-	-	-
Financial Assets held to Maturity [1]	66,993	-	-	-	-	-	-	-	-
Receivables [2]	21,585	-	-	-	-	-	-	-	-
Fixed Income Securities [3]	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
Total increase/(decrease)		**(1,128)**	**(1,128)**	**1,128**	**1,128**	**(48,150)**	**(48,150)**	**48,150**	**48,150**
31 December 2016									
Financial Assets									
Cash & cash equivalents	68,672	(687)	(687)	687	687	-	-	-	-
Financial Assets held to Maturity [1]	64,390	-	-	-	-	-	-	-	-
Receivables [2]	22,662	-	-	-	-	-	-	-	-
Fixed Income Securities [3]	81,482	-	-	-	-	(8,148)	(8,148)	8,148	8,148
Listed Trusts	149,649	-	-	-	-	(14,965)	(14,965)	14,965	14,965
Growth Securities	249,235	-	-	-	-	(24,924)	(24,924)	24,924	24,924
Total increase/(decrease)		**(687)**	**(687)**	**687**	**687**	**(48,037)**	**(48,037)**	**48,037**	**48,037**

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.

10. Financial Instruments (continued)

(e) Fair value measurement (continued)

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

	Level 1 $	Level 2 $	Level 3 $	2017 Total $
Financial assets at fair value				
Fixed Income Securities	89,704	-	-	89,704
Listed Trusts	129,643	-	-	129,643
Growth Securities	262,157	-	-	262,157
	481,504	**-**	**-**	**481,504**

	Level 1 $	Level 2 $	Level 3 $	2016 Total $
Financial assets at fair value				
Fixed Income Securities	81,482	-	-	81,482
Listed Trusts	149,649	-	-	149,649
Growth Securities	249,235	-	-	249,235
	480,366	**-**	**-**	**480,366**

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

11. Related Parties

During the year, the Trust incurred $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.

12. Commitments for Expenditure

The Trust has no commitments for expenditure as at 31 December 2017.

13. Contingent Assets and Liabilities

The Trust has no contingent assets or liabilities as at 31 December 2017.

14. 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

14817–APR18