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# Online Farm Trials (OFT) – the past, present and future

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## Abstract

Online Farm Trials (OFT) ([www.farmtrials.com.au](http://www.farmtrials.com.au)) is a free web-based resource and trial discovery system that contains more than 7,100 trials from 76 different organisations from across Australia. Since its inception in 2013, OFT has developed via a collaborative approach with grower groups, research organisations, agricultural experts and grains industry organisations. This ensures the outcomes are highly relevant, practical and beneficial for growers. Users can view, analyse and export grains research data as well as compare trials based upon historical, geographic and crop-specific search filters. Current developments include seasonally relevant collections of trials to highlight priority topics and aid on-farm decision making. To meet the future needs of industry stakeholders, system developments are planned to include expanded trial research information access, foster innovation through publishing and promoting active trials and enhance trial data standards and quality.

## Key Words

Information and data repository, metadata, data quality, web-based system

## Introduction

Grain trials in Australia have been a valuable training and education resource for generations of agriculturalists. Conventionally in the 1800s, many trials were initially based around rotations between crop types and sectors, cultivation practices including new machinery, application of manures and bone dust and superphosphate of lime. In Victoria, an example of farm trials was those conducted by colonial agricultural and horticultural societies in the 1860s and 1870s prior to the establishment of the Department of Agriculture in 1872. As an example, cereal trials conducted in 1865 drew widespread interest and enthusiasm on experiments with plants and manures in small plots north of Melbourne (Ostapenko 2011). In the 1880s, William Farrer began plot trials to evaluate cross-breeding for ‘quality’ and ‘higher yielding’ varieties. Trials at Port Fairy (commenced around 1890), Nhill, Swan Hill and Dookie were evaluating wheat, oats and barley for resistance traits. As McAlpine (1902) states *‘by selection and crossing wheats are being evolved suited to Australian conditions, which means that they are fitted to resist rust, and generally have good yielding and milling qualities.’*

For more than 150 years, grain trials have been conducted in Australia with the aim of improving yield and financial rewards to growers. Trials have been undertaken to evaluate new higher yield cultivars, responses to pest and disease limitations to plant growth, crop rotations, mechanical or logistical impediments around harvesting and maximizing outputs from application of fertilisers and ameliorants. In Australia, wheat yields have steadily increased with the adoption of new technologies, varieties and practices. Average yields of 1 t/ha around the 1940s have climbed to a projected 1.91 t/ha for 2018-19 (ABARES 2017). While productivity growth in grains has remained between 1.3 and 1.9% per year, yields are still considerably less than their potential even with recognised climatic pressures (Hochman and Horan 2018). While changing climate is a major contributing factor in stalling yields, limited access to relevant information including extension activities on latest best management practices is contributing to lower potential productivity (Sheng *et al.* 2011). Sharing and dissemination of latest grains trial research, information and knowledge across the industry is an advocated approach to support this need (Walters *et al.* 2017). The provision of trial information to growers and advisors using an online ‘one-stop shop’ as a central information repository is recommended (Stone 2010). Key reasons for such an information system include:

- enable financial savings to industry and focus R, D & E investment by avoiding duplication of previous research trials;
- connect growers, advisors and researchers on latest R&D;
- help guide future R, D & E investment and directions by leveraging past trial information;
- enable new learnings by industry partners and stakeholders through consolidation and synthesis of trials research; and
- manage the diversity of grains related trials in Australia.

This paper presents a brief narrative on the history of Online Farm Trials, current developments and prospects.

### Online Farm Trials

The Online Farm Trials (OFT) project began in 2013 with a goal to ‘maximise access to current and past grains industry research data, with the aim to provide a resource for industry stakeholders’ (Murphy *et al.* 2015). Supported by the Grains Research and Development Corporation (GRDC), trial contributors to the system and delivered by the Centre for eResearch and Digital Innovation (CeRDI) at Federation University, OFT is based on key knowledge sharing principles:

- that data access rights and processes are entirely governed by the researcher and access rights can be adapted to maintain existing membership policies of the group or organisation;
- that the individual, group or research organisation supplying farm trial research remains the owner of the information supplied and retains all intellectual property rights;
- that the source and ownership of all data will be fully acknowledged and attributed; and
- that the researcher maintains full control of trial data and information on the OFT database and may remove, edit and update information at any time.

Grains research trials are accessible via a web-based information system ([www.farmtrials.com.au](http://www.farmtrials.com.au)) that is free and includes a range of search and filter options to enable users to expediently access trials information and topics of interest, e.g. management strategies for *ascochyta blight* in chickpeas. Since the inception of OFT in late 2013 involving 3 trial contributors, the number of trials has increased by over 1300 trials per year with 85% of trials published for open access and use (Table 1). Trial contributors have also increased significantly to 76 in March 2019. Trial contributors to OFT include a diverse range of industry partners such as grower groups, commercial businesses including agronomic consultancies, NRM/Landcare groups, universities, state and territory governments, federal government and private enterprises. All contributors are provided with guides to enter trials data into the system, while users are also provided with online videos and static guides to support their search and information requests.

**Table 1. Increase in trial projects accessible through OFT (2014-2019).**

Date	Trial contributors	Total trial projects	Trials with a report	Published trial projects	Trials with result data
Sept 2014	5	2,593	1,519	2,432	1,249
Jul 2015	10	2,903	1,680	2,517	1,509
Jun 2016	45	3,298	2,807	3,090	2,032
Jun 2017	57	4,408	3,318	3,982	2,488
Jun 2018	71	6,540	5,280	5,537	3,145
Mar 2019	76	7,117	6,371	5,908	3,226

In 2017, an external data audit consisting of an online survey and telephone interviews was conducted with 50 organisations. Audit participants included grower groups (n=19), agronomic consultancies (n=8), government departments (n=7), research organisations including commercial and national science entities (n=5), universities (n=3), private entities other than agronomy (n=5) and NRM/Landcare groups (n=3). Participants were asked to estimate the number of trials their organisation had been involved with over the organisation’s lifespan (Figure 1). Many of these trial estimates are likely to be conservative given the long history of grains trial research conducted by government and private organisations in Australia since the 1850s. In addition, a significant percentage of total trial estimates comprise vast quantities of legacy trials and associated data from across Australia. Participants also provided details on which crops were featured in these trials (Figure 2), research theme or production issue (not presented). An internal audit of the OFT system conducted in February 2018 identified that there were over 100,000 results for various combinations of crop types and treatments. Over 70 percent of measurements were for seven measures including grain yield estimates, protein content, screenings, plant density, plant biomass, oil content and gross margin.

### Current system developments

#### *Improving trial data quality and metadata*

Trial contributors to OFT have been encouraged to populate fields in the entry system that are largely voluntary, e.g. trial aims, key messages, sowing and harvest details. An expanded set of mandatory fields has been set to enable users of the system to systematically look for relevant trial details. As an example, trials

are now assigned a 'trial type' either as 'experimental' or 'demonstration'. As there are legacy trials where metadata records may no longer exist, there is the ability to classify a trial type as 'unknown'. For experimental trials, design factors can also be tagged including replication (n), randomisation and blocking. Another enhancement to the system is that a trial must be assessed for any unusual or adverse factors that may have impacted trial results. This enables users of OFT to be made aware of trials impacted by environmental factors (e.g. frost, extreme wind causing grain loss) or consider these impacts on trial results.

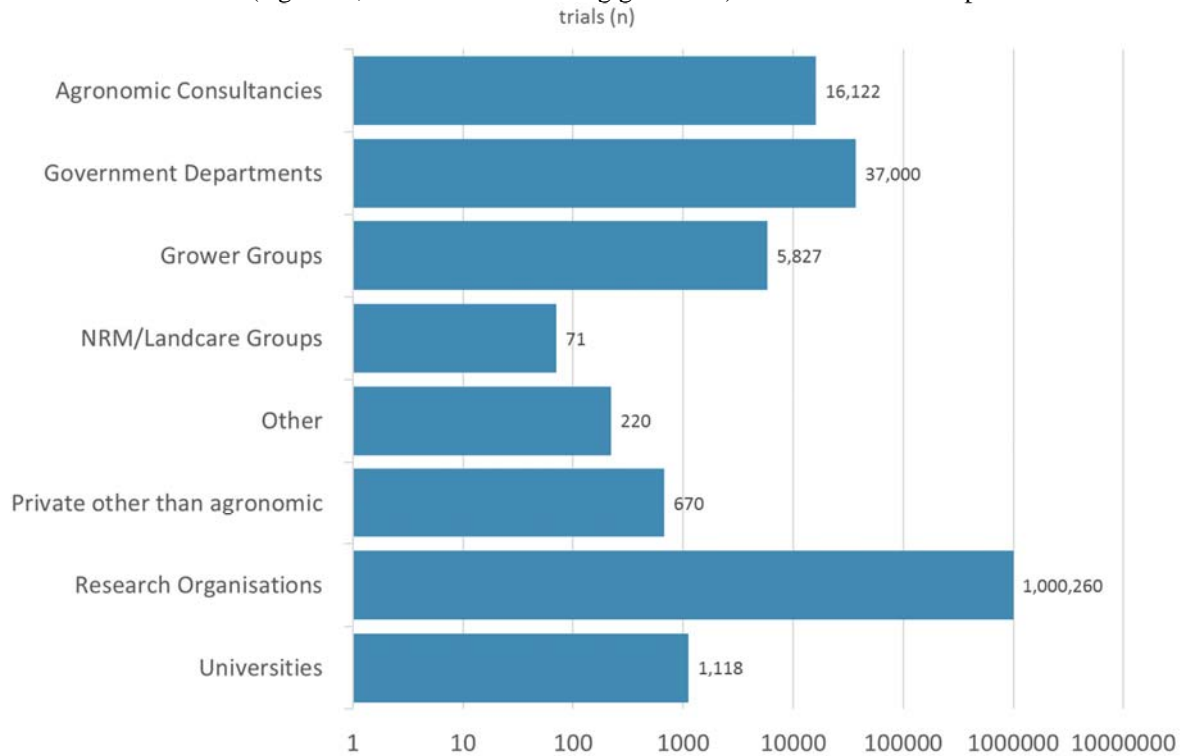


Figure 1. Total number of trials reported by organisation type (log<sub>10</sub> scale).

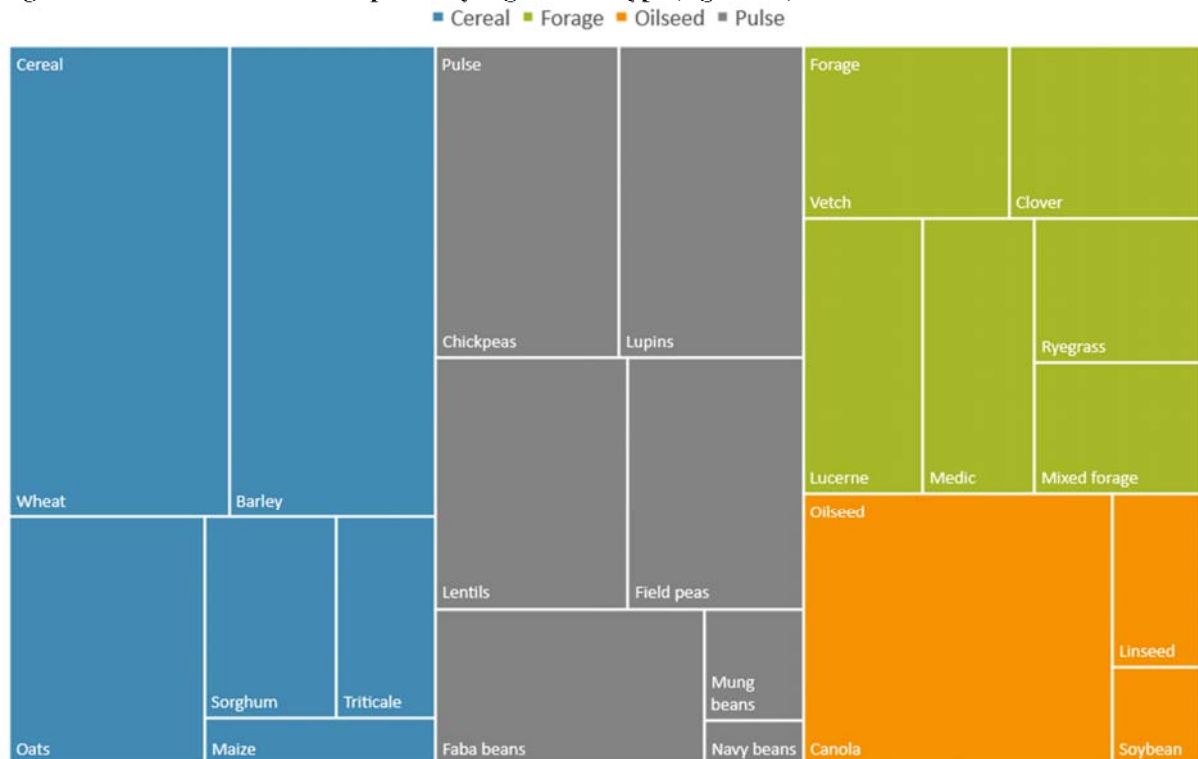


Figure 2. Treemap with crop sectors and crop types (note for scale: Wheat = 98% and Navy beans = 4%).

### *Supporting current industry research programs and trial information*

Current and recently completed research programs supported by GRDC have now been included in trials accessible to users. The *Southern Pulse Agronomy* tri-state research program includes over 400 trials on increasing farm profitability, reliability and profitability of pulses in southern Australia. Key research foci for these trials include evaluating new pulse varieties, spraying and sowing options and future breeding priorities. The *Managing profitable farming systems with retained stubble* program involved contributions from 10 grower groups (162 trials) and research organisations on how to manage and retain stubbles across ecosystems of eastern Australia. A third, key supported program on OFT is the *Management of barley and barley cultivars for the Southern Region* project where 39 trials were undertaken to improve the productivity of growers and increase adoption of improved barley cultivars.

### *Making the system more robust to accommodate the diversity of grains related trials in Australia*

Many organisations are now conducting trials with sophisticated designs to maximise the potential of a trial answer many questions posed. This may involve multiple trial sites, multiple years of experimental results and many different statistical parameters being reported. New functionality has been enabled for trial contributors to OFT to link trials and sites as well as multiple years of trial data. This was a desired feature by trial contributors to convey to users of the system that a trial should not necessarily be considered in isolation as trial results may be variable and inconsistent due to a range of environmental or other confounding factors, or that trials may be part of a systems approach to grains production.

### **The Future**

New system improvements are planned for 2019 to enable trial contributors to share their ‘trials in progress’ with the grains community. The focus of this additional functionality in OFT is to promote current season trials amongst contributor members, but also to enable those interested in a trial to connect with organisations and researchers on their research. The inclusion of new and contemporary trials into OFT remains a focus while still supporting organisations to contribute legacy trials into the system. Further enhancements are also being enabled to support trial contributors to submit and manage all their data associated with a trial in OFT. This will allow trial contributors to share trial data according to their business rules as well as providing a repository for data that may be lost or misplaced with time. Potential new system operations to facilitate trial reporting for members and industry partners is being explored as part of proposed ‘active trial management’. This will enable trials data to be seamlessly captured and managed towards meeting FAIR principles (*findable, accessible, interoperable and reusable*) of sharing trial data.

### **Conclusion**

Online Farm Trials continues to provide a service to the Australian grains industry to support connecting advisors and growers with latest trial research. The web-based system provides a platform to support those conducting grains related trials while delivering knowledge on all profit drivers in grains production systems.

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