FARM BUSINESS UPDATE

STRATEGIC STEPS – ENDURING PROFIT

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

Bendigo

Tuesday 20th March

9.00am to 4.30pm

All Seasons Hotel,

171-183 McIvor Road, Bendigo

#GRDCUpdates

2018 Bendigo GRDC Farm Business Update planning committee

Andrew Bissett	*Wheelhouse Fertilisers*	**Andrew Loorham**	*Nuseed*
Garry Chambers	*Strategem*	**Anna McGee**	*Rural Financial Counselling*
Ciara Cullen	*BCG*	**Lloyd Nielsen**	*NAB*
Chris Dunn	*Landmark*	**Phil O'Callaghan**	*ORM*
Rebecca Dunsmuir	*CBA*	**Keith Pengilley**	*GRDC*
Jane Foster	*ORM*	**Craig Ruchs**	*GRDC*
Charles Gebhardt	*Elders/Rural Bank*	**David Smith**	*ORM*
Brad Knight	*GeoCommodities*	**Grant Thomas**	*Rural Bank*

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Bendigo GRDC Farm Business Update convened by ORM Pty Ltd.

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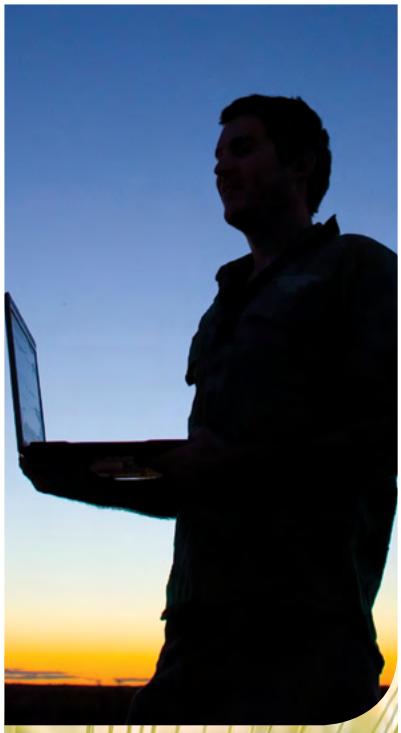

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GRDC Welcome

Welcome to the GRDC's Farm Business Update program for the Southern Region.

This is the eighth year of operation for the Farm Business Updates across the Southern Region. Feedback from the events, both grower and adviser updates, has been very positive.
Most significantly, they provide a unique opportunity to cover business management issues and hear from presenters not covered elsewhere.

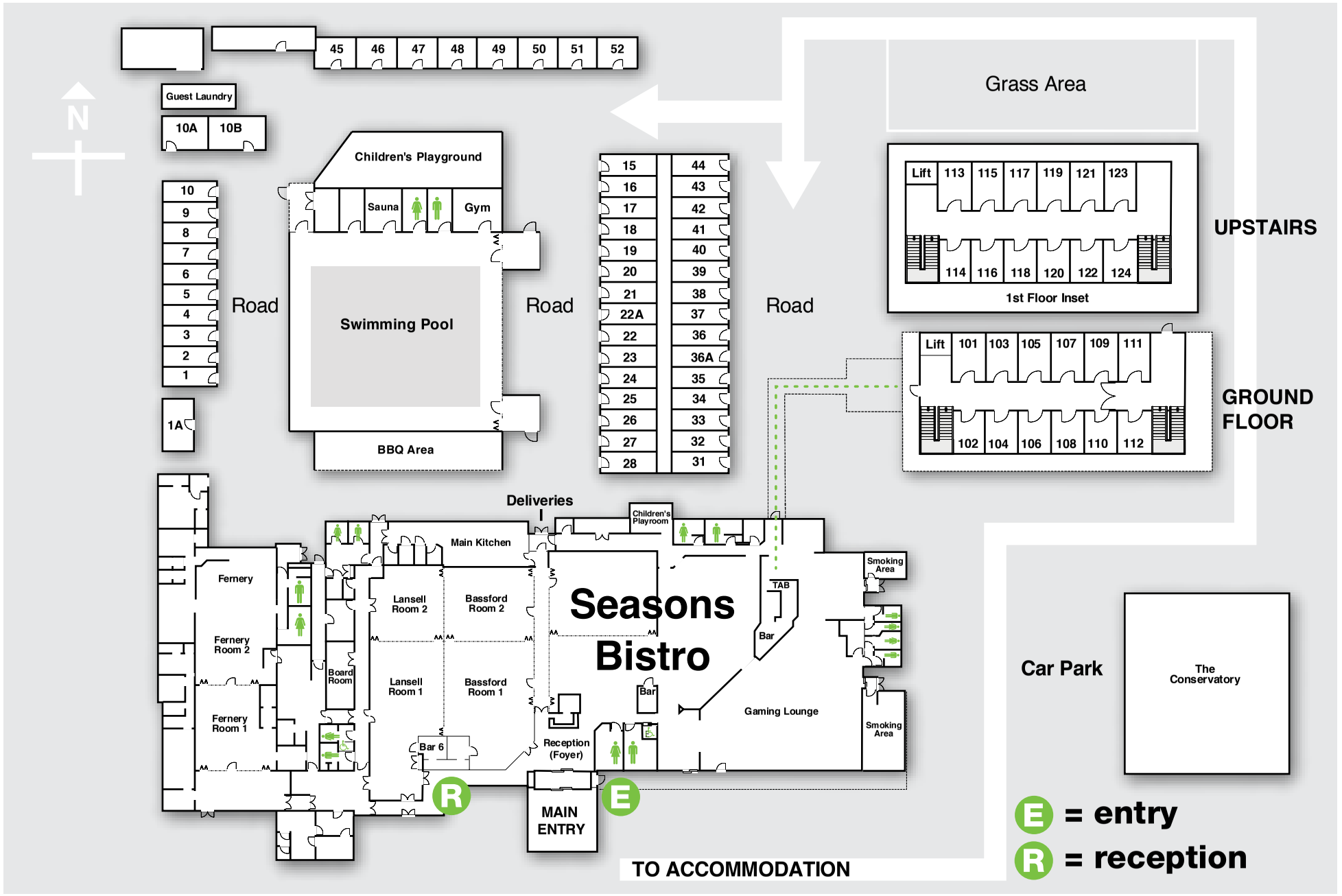
Business management skills and knowledge are critical to running a successful farm business. The decision making process are becoming increasingly complex as farm businesses strive to meet the key challenges of increasing costs, declining 'real' prices and often erratic climatic conditions.

GRDC will continue to bring new topics and presenters relevant to growers and advisers through the Farm Business Updates. In doing so, the Update Planning Committees play a critical role in 'keeping an ear to the ground' for topical issues and are also actively developing a network of presenters skilled in farm business management. If you are interested in contributing to the planning of the Updates, I encourage you to get in touch with the team at ORM.

Our aim is to ensure that the Farm Business Update is both informative and thought provoking. Adding to this aim, the Update is designed to allow you to strengthen your professional network, putting you in touch with other likeminded advisers focused on farm business management.

KEITH PENGILLEY

Chair GRDC Southern Regional Panel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1st Floor Inset
UPSTAIRS
Lift 101 103 105 107 109 111
102 104 106 108 110 112
GROUND FLOOR
Deliveries
Children's Playroom
Main Kitchen
Fernery
Fernery Room 2
Fernery Room 1
Board Room
Lansell Room 2
Lansell Room 1
Bassford Room 2
Bassford Room 1
Seasons Bistro
Bar 6
Reception (Foyer)
Bar
TAB
Bar
Gaming Lounge
Smoking Area
Smoking Area
R
E
MAIN ENTRY
TO ACCOMMODATION
Car Park
The Conservatory
E = entry
R = reception

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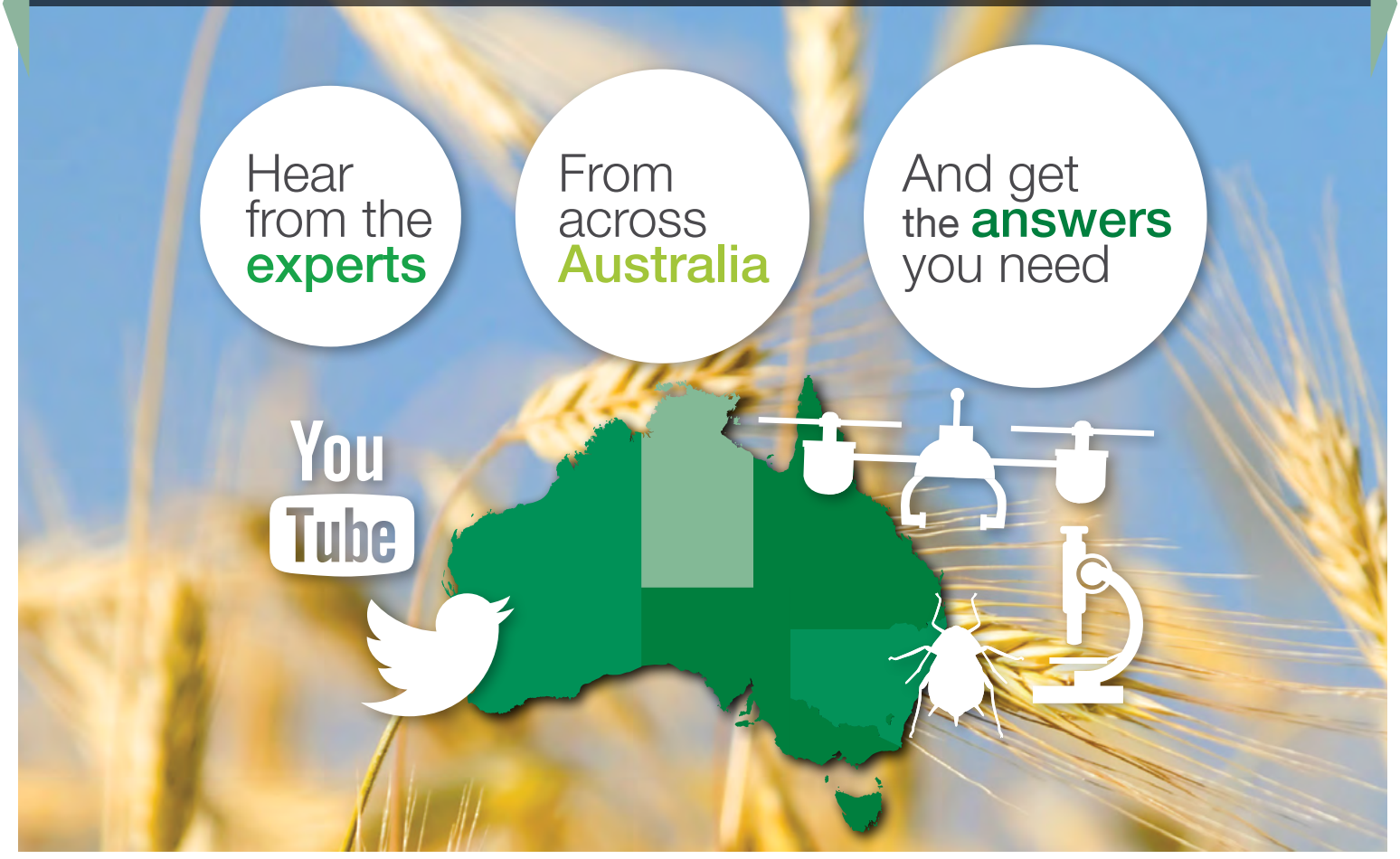

NSW GOVERNMENT Department of Primary Industries

AGRICULTURE VICTORIA

Program

9.00 am	**Announcements**	***ORM***
9.05 am	**GRDC welcome and opening**	***GRDC***
9.15 am	**Leveraging your production environment to achieve enduring profitability**	***Steve Jefferies,*** *GRDC*
10.00 am	**How to think about emerging technologies**	***Paul Higgins,*** *Emergent Futures*
10.45 am	***Morning tea***	

CONCURRENT SESSIONS *(50 minutes which allows 5 minutes for room change)*

	Lansell & Bassford	*Fernery 1*	*Fernery 2*
11.15 am	**Planning and measuring sustained profitability, allocating resources more efficiently and reducing operational risk – case study** ***Phil O'Callaghan,*** *ORM Pty Ltd*	**Solving farm business challenges with technology innovation – developing an idea into a working business solution** ***Naomi Stuart,*** *FARMpay*	**Panel – planning for farm business succession** ***Daniel Cole,*** *Beck Legal,* ***Stuart McKenzie,*** *Strategem and* ***Nigel McGuckian***
12.05 pm	**On-farm storage systems for grain – how on-farm storage can enhance harvest productivity and logistics** ***Peter Botta,*** *PCB Consulting*	**How data evolution is changing the capabilities for variable rate technology application and outcomes** ***Andrew Whitlock,*** *Precision Agriculture*	**Preparing the next generation for leadership** ***Jill Briggs,*** *Affectus P/L*
12.55 pm	***Lunch***		
1.45 pm	**Planning and measuring sustained profitability, allocating resources more efficiently and reducing operational risk – case study** ***Phil O'Callaghan,*** *ORM Pty Ltd*	**Solving farm business challenges with technology innovation – developing an idea into a working business solution** ***Naomi Stuart,*** *FARMpay*	**Preparing the next generation for leadership** ***Jill Briggs,*** *Affectus P/L*
2.35 pm	**On-farm storage systems for grain – how on-farm storage can enhance harvest productivity and logistics** ***Peter Botta,*** *PCB Consulting*	**How data evolution is changing the capabilities for variable rate technology application and outcomes** ***Andrew Whitlock,*** *Precision Agriculture*	**Panel – planning for farm business succession** ***Daniel Cole,*** *Beck Legal,* ***Stuart McKenzie,*** *Strategem and* ***Nigel McGuckian***
3.25 pm	**Fatigue prevention – health and wellbeing**		***John Toomey,*** *The Fatigue Prevention Company*
4.10 pm	**Close and evaluation**		***ORM***

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Farming the Business

Sowing for your future

The GRDC's **Farming the Business** manual is for farmers and advisers to improve their farm business management skills.

It is segmented into three modules to address the following critical questions:

- **Module 1: What do I need to know about business to manage my farm business successfully?**
- **Module 2: Where is my business now and where do I want it to be?**
- **Module 3: How do I take my business to the next level?**

The **Farming the Business** manual is available as:

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  There is a postage and handling charge of $10.00. Limited copies available.
- **PDF** – Downloadable from the GRDC website – **www.grdc.com.au/FarmingTheBusiness**
  or
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Australian Government
Grains Research and Development Corporation

2018–23 STRATEGIC RESEARCH, DEVELOPMENT AND EXTENSION PLAN
CONSULTATION PLAN & INITIAL DISCUSSION PAPER

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

For the most current information relating to the 2018-2023 Strategic Research, Development & Extension plan, please refer to; the GRDC website https://grdc.com.au/about/corporate-governance/strategic-rd-plan

Introduction

The Grains Research and Development Corporation (GRDC) has been delivering outcomes from grains research, development and extension (RD&E) on behalf of Australia's grains growers and the Australian Government for 25 years.

Our purpose is to invest in RD&E to create enduring profit for Australian grain growers.

In supporting our purpose, GRDC works closely with Australian grain growers and the Australian Government to ensure that their RD&E priorities are effectively addressed through GRDC investments. We also maintain strong connections with our other stakeholders, particularly in the R&D and agribusiness sectors.

GRDC has commenced development of the Strategic Research, Development and Extension Plan for 2018–23 (RD&E Plan), which outlines the objectives, strategies and key investment targets over the next five years in the context of a 10 to 15 year time horizon given the significant effort and time required for delivery and adoption of many R&D outcomes.

The 2018-23 Strategic R&D Plan will be informed by consultation with Australian grain growers, research partners, agribusiness, government representatives and other relevant stakeholders. As detailed in this plan, a series of engagement activities will be undertaken throughout 2017 and 2018 seeking stakeholder input and feedback.

Legislative framework for the R&D Plan

The GRDC R&D Plan 2018–23 will be the principal planning and operational document for the Corporation. The plan will convey GRDC's purpose and core activities, explain the environment and context in which it operates, its planned performance, risk profile and capabilities.

The key legislation affecting and shaping the R&D Plan includes:

- *Primary Industries Research and Development Act 1989* (PIRD Act)

Under the PIRD Act RDCs are required to have a 5-year R&D Plan that incorporates a statement of the Corporation's objectives and priorities and an outline of strategies that the Corporation intends to employ to achieve these objectives. The Plan must be approved by the portfolio minister, in this instance the Deputy Prime Minister.

- *Public Governance, Performance and Accountability Act 2013* (PGPA Act)

The *Annual Performance Statement*, required under the PGPA Act reports actual results achieved on an annual basis against the planned performance set out in the R&D Plan and further elaborated in Portfolio Budget Statements (PBS).

- Funding Agreement between the Commonwealth and the GRDC

The Funding Agreement, which took effect on 2 June 2015, requires the development of an R&D Plan in accordance with the PIRD Act and additionally the development of a consultation plan including details of proposed consultations with the Commonwealth and GRDC's Representative Organisations and other stakeholders as appropriate, including, but not limited to, other RDCs.

The consultation plan must be agreed with the Commonwealth and be published on the GRDC's public website prior to consultation commencing. This document constitutes the consultation plan and initial discussion document for the 2018–23 GRDC R&D Plan development.

GRDC Purpose & Investment Balance

The next five-year R&D plan is part of a longer-term (10-15 year) strategy to deliver on GRDC's purpose:

To invest in research, development and extension to create enduring profitability of Australian grain growers.

Drivers of grain grower profitability can be simply described in terms of yield, price, production and post farm costs and risk. That is:

Profit (π) =[Yield (Y) x Price (P) – Costs (on farm + post farm)] x Risk (R)

It is important to note that profit drivers differ across multiple businesses, enterprises and environments and these do have significant impacts not only on the potential shape and scope of GRDC's R&D investment portfolio, but also on the likely adoption of R&D outputs and therefore the effectiveness of GRDC investments in delivering opportunities to improve profit.

For the 2018-23 RD&E Plan, GRDC is looking to develop strategy and investments to deliver outcomes against the broad components of profitability through:

- Increases in yield.
- Better prices.
- Decreased production and post farm costs.

Investment Balance

Clearly the profit drivers above interact (e.g. increases in yield can be achieved but if they also require increased costs that outweigh the yield benefit delivery on creating profit will not be achieved). Equally, all opportunities to influence a profit driver need to take into account risk. The purpose of GRDC is to create ENDURING profitability. Crop production is a risky business and opportunities to increase profit need to be assessed in a framework of managing risk.

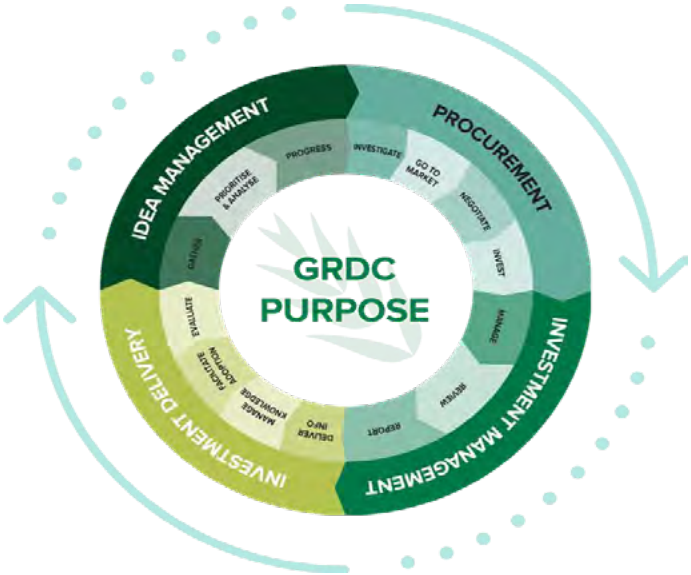
Opportunities to increase yield, increase price or decrease costs can also be incremental or transformational in nature. Incremental profit improvements are important to keep Australian grain growers competitive in the current international market. R,D&E to support incremental improvement generally delivers on-farm changes in the short to medium term (up to 8 years) and is characterised by investments where the technical risk of delivery that is either low or moderate. Transformational change is required for Australian grain growers to remain competitive in the long term. R&D to support transformational change is generally high risk and requires longer time periods for delivery and adoption.

In keeping with the focus on an investment culture, GRDC must balance the need for continual incremental improvements in profit with the desire for larger transformational changes.

Question: What does your institution consider to be the appropriate balance between investment in incremental and transformational improvements to enduring profit of grain growers?

Continuous Investment Cycle

The 2017-18 financial year will see the GRDC move away from a single annual call for investments to one of continuous investment assessment and calls throughout the year. This will provide the GRDC with the agility to quickly deliver solutions when and where they are needed and in the form that best meets grower needs, while maintaining a pipeline of investments to ensure Australia is at the forefront of future innovation.



The GRDC will invest in ideas throughout the year, considering investments as part of ongoing scheduled Panel meetings and integrated into the usual GRDC business activities.

Importantly, the continuous investment cycle provides for comprehensive analysis of ideas in a digital workspace that allows for experts in the appropriate field to come together to discuss and provide input to the GRDC to assist with the development of investment proposals. Experts need not be affiliated with GRDC nor necessarily just from Australia and mechanisms have been included to allow for expert contributions to be made without compromising the capacity of a researcher to apply for investment.

Following analysis, appropriate contracts will be developed to measure success against milestones and successfully completed milestones will attract progress payments.

Potential Investment Targets

Preliminary planning with the GRDC Board and Regional Advisory Panels have identified a range of potential investment targets, both transformational and incremental, that could contribute to improvements in profit. The board and panels have generated an extensive list of potential investment targets and some examples (but not a full overview) of some of these are provided below to provide context to the types of investments that will be considered in the next R&D plan. Based on these examples, the GRDC is interested to learn from your institution, the potential transformational and/or incremental investments that could deliver enduring profit through increases in yield, better prices or decreased costs.

Increases in yield

Addressing consistency of yield of break crops across different environments and variable seasons

Australian grain production has historically focused on maximising returns from wheat and barley with canola, pulses and pasture legumes utilised as break crops predominately to address weed and disease pressures as well as soil constraints. This use of break crops remains an important part of modern production systems but break crops (especially canola, lentils and chickpeas) are also being targeted as important profit sources in their own right. Realising the potential incremental impact of break crops as part of a cereal rotation or the transformational impact of maximising returns from canola, lentil and chickpeas requires a greater R&D effort focused on improving break crop genetics to maximise yield potential across a range of environments. In addition, R,D&E to understand how best to incorporate these crops in different farming systems is required to realise improved yield potential and maximise profit.

Temperature Tolerance

The majority of Australian grain growers would have experienced the disappointment of losing significant crop yield through the impact of frost and/or heat at grain set and filling. The nature of the Australian grain production environments dictates that growers will continue to be required to balance maximising yield through sowing time and variety selection with the risks of frost and heat impacts. Improvements in extreme temperature tolerance of crops would not only be transformational in

minimising yield losses but also have the potential to significantly improve overall yield potential by increasing the sowing time and variety choices available.

Better Prices

Matching inputs to market requirements

Incremental improvements in prices growers receive can be achieved through matching inputs with market requirements. As yields, particularly of wheat and barley, have improved many growers have suffered downgrading as a result of not meeting protein specifications for higher-grade grain. Understanding the management practices and potential genetic variability effects of the relationship between nitrogen application and grain protein provides the opportunity to limit profit losses through price discounts because of downgrading.

Niche products and alternative uses of current grains

Opportunities for transformational improvements in grain prices relate predominately to transitioning grain from a bulk commodity toward a more specialist product either through the development of new niche grains or through the identification of new uses for existing grain. GRDC has historically invested in the development of niche grains in a limited capacity but with significant outcomes. For example, GRDC is a core partner in the development of both omega-3 canola and ultra-low gluten barley (Kebari). There is an opportunity for GRDC to expand its portfolio in this area but only where benefits will be delivered to a significant number of Australian grain growers (that is a significant market for the product exists or is likely to develop).

Decreased production costs

Automation opportunities

Labour and capital equipment represent significant costs in most farm businesses. Labour impacts are further compounded by a lack of access to appropriately skilled people as required throughout the season. While automation associated with GPS location and autosteer has been widely adopted in the Australian grains industry, there are opportunities to further explore the potential use of automation. Opportunities may be incremental and involve the automation of discrete tasks to reduce wages, lower human error or ensure timely completion. Other opportunities may be more transformational in nature and include the widespread use of automation across the entire production and freight system in a fully integrated manner to minimise costs.

Sensing technologies

Opportunities to decrease production costs by matching inputs to environmental variables (water availability, current nutrient levels, soil constraints, weed spectrum etc.) are often not realised because measurement of the environmental variables is either too difficult or too time consuming. Advances in sensing and imaging technology (not only in agriculture but also in other disciplines such as medicine and physics) provide the prospect of cheaply and quickly measuring critical production variables in order to maximise input efficiencies and decrease production costs.

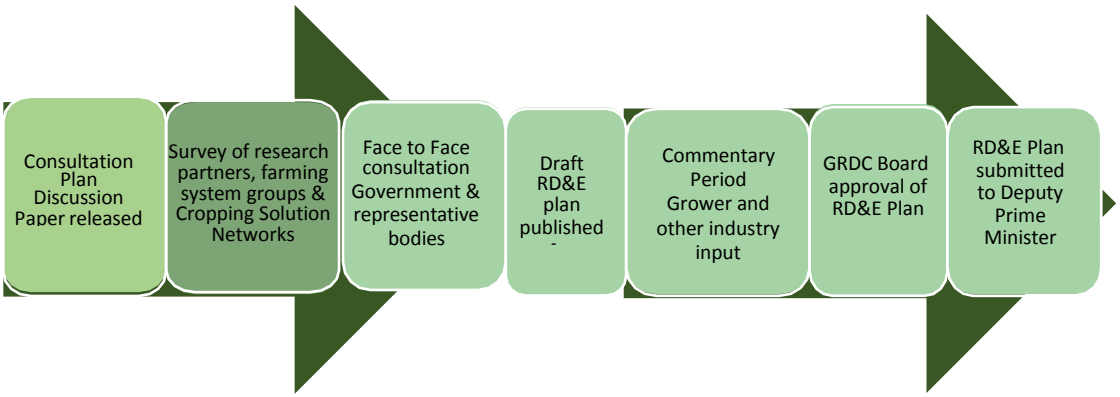
Decreased post farm gate costs

Reducing freight and logistic costs

Australia's major grain markets are located in SE Asia. Australia should be a preferred provider into these markets given their close proximity and therefore lower port to port freight costs in comparison to other grain producing countries. While current international freight rates remain low and decrease at least some of Australia's freight advantage, inefficiencies in the internal freight system not only have a major financial impact on grower costs but also have a significant social impact on rural and regional communities. While it is outside of GRDC's remit to directly invest in grain logistics, there are opportunities to undertake R&D to understand where the inefficiencies in the current structures lie, why they occur and what opportunities exist to address them, if any?

Stakeholders and consultation

A core feature of the development of the GRDC R&D Plan entails incorporating input from growers and their advisers, the Australian Government, each of the GRDC's representative organisations (Grain Producers Australia and GrainGrowers Limited), research partners and other stakeholders to help shape the GRDC's investment priorities and strategies. A tactical and practical stakeholder engagement approach is being employed to obtain insights and perspectives that will help shape the R&D plan as described below and outlined below.



Jul 2017|| Jul 2017|| Aug - Sept 2017||Oct - Dec 2017|| Jan 2018 || Jan-Feb 2018||Feb-Mar 2018|| Mar 2018||

GRDC will employ a number of consultation approaches customised to different target audiences. These will include but are not limited to:

- Workshops
- Face to face meetings
- Surveys
- Social Media
- Calls for comment

We will also make levy payers and other stakeholders aware of progress and opportunities to comment through our premier in house publication GroundCover™, which is distributed through a physical mail out as well as digitally via email and our website.

Initial survey

The initial survey is the first approach to stakeholders seeking broad-brush input on opportunities to impact profit through yield, price and cost drivers as outlined above. The survey will be targeted at farming system groups and cropping solution networks as well as our research partners and the input obtained utilised to inform the Draft R&D plan to be published in January.

Face to face consultation and workshops

Following the initial survey, GRDC will consult with the Australian Government and hold workshops with grower representative bodies to further inform the content and structure of the draft R,D&E plan. These interactions are expected to be completed in time for the draft plan to be published in December/January.

Commentary period

Upon publication of the draft R,D&E plan GRDC will seek comment from a wide cross section of the grains industry including individual growers, advisers, researchers, agribusiness, government, other RDCs, international collaborators, advisory panels and staff. Relevant input will be incorporated into the final

R,D&E plan for submission to the Minister for Agriculture and Water Resources.

Finalisation and publication

Following approval by the Minister for Agriculture and Water Resources, the R,D&E plan will be published on the GRDC website. However, it is important to note that this plan is intended to be a "living document" and, in line with GRDC's intent to become more agile and responsive, will be subject to change as internal and external factors continue to impact on the Australian grains industry.

Further information

For further information regarding the RD&E plan development process and consultation activities, please contact:

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Notes

How to think about emerging technologies

Paul Higgins.

Emergent Futures.

Keywords

- artificial intelligence, drones, big data, blockchain, innovation, technology.

Take home messages

- Drones utilise the technologies of smart phones and tablets, this mean rapid advances are already imminent and will develop quickly over the next five years.
- Artificial intelligence (AI) systems are at the beginning of their evolution, the important aspects are ability to deliver real value and data ownership.
- Blockchain technologies have an application in agriculture (beyond the hype of cryptocurrency), this could lead to increased transparency on the movement of commodities through the value chain. The potential for manufacturers to impose production specifications becomes an increasing probability with the take up of this technology.
- Advisers will continue to play a critical role on-farm; industry knowledge with local understanding as well as networks of expertise to draw from on the latest technology and data services will be important in the future.

Introduction

Emerging technologies have a long arc from the genesis of the original idea, to custom built models, through to industrialised models and finally to utilities or commodities. Think of the development of computers from the early mechanical concepts of Charles Babbage and Ada Lovelace in the 19th century, through to the custom-built models of the fifties, sixties and seventies, on to the industrialised models of Hewlett Packard and Dell, and now to a world where you can hire computing services by the second from Amazon or Google. The same cycle applies to electricity, or cars, or a myriad of technologies.

The arc is a way to think about change although the time frames for each stage differ. In the present day there is an acceleration of the time frames, but even things we think about as being relatively recent developments have a long history. Take artificial intelligence (AI), research on AI started in the forties or fifties depending on who you listen to and how you define the term. Real developments of any significance had to wait until the further developments of computers. There was much excitement in the eighties over the possibilities for AI. However, the technology failed to live up to its promise and an 'AI winter' descended for about 20 years before the field accelerated again. Now we are seeing many AI products and the big technology companies supply machine learning as a service on top of their computing services. Both computers and AI are an example of the 'adjacent possible'. What this means is that while the concepts of a technology may be strong sometimes a technology has to wait until the underlying components are developed enough to make it a practical reality. The design that Charles Babbage created in the 19th century is still the basic architecture for computers today, but he had to build it from mechanical parts. We had to wait for the development of silicon, and integrated circuits before the actual applications could take off.

For those that want to think more about this I would recommend Steven Johnson's excellent book; Where Good Ideas Come From: The Natural History of Innovation (https://www.amazon.com.au/Where-Good-Ideas-Come-Innovation-ebook/dp/B0046ZRZ30/ref=sr_1_1?s=digital-text&ie=UTF8&qid=1518657389&sr=1-1&keywords=Where+Good+Ideas+Come+From).

A story of early innovation in agriculture was when farmers in the USA used barbed wire fences as telephone lines. Grabbing adjacent technologies and making something new out of them.

So, when we think about emerging technologies in agriculture, we should think about:

- The arc – where is this technology along the arc from idea to utility/commodity?
- At what stage of development are the underlying and adjacent technologies that are needed to make the technology a practical reality?

And just as importantly in the case or agriculture, how 'hardened' is the technology? It is fine for the technology to work in a laboratory or in a comfortable city environment but is it too fragile to stand up to practical applications on-farm or along the supply chain. Barbed wire as telephone wires worked because it was an already installed technology that was resilient in the real world.

So with these concepts in mind, let's look at a few emerging technologies and where they might be heading.

Drones

Drones have been around in agriculture for a while now with some early adopters having drones on their farms for years. Where they sit on the arc of technology development is somewhere between custom built and industrialised models. This applies to the drones themselves, the software components, and the applications for farming operations. Where they are likely to head is a utility of a commodity model that is akin to Uber today. If we look at what is happening in the mining and construction industries we can see some clues about what might happen. Drones are being used in more and more sophisticated applications to map environments. The drones are being used to get three dimensional pictures of mining sites and construction sites which can then be compared to previous data, and 3-D plans. Computer systems can then use this data to track development, mining volumes, consumption of materials, etc. A good example of this is Site Scan from 3DR (Figure 1). This system is being continually improved to make it into an industrialised model that is intuitive to use via simple interfaces.

Where we are heading in the medium term is best represented by Airobotics (https://www.airoboticsdrones.com/) who provide an automated drone service for the mining industry (Figure 2). This is an automated drone airport that can be towed to a site. The drone inside is automatically fitted with programmed hardware that will carry out the required tasks. The drone then flies on a pre-planned flight, goes back to the automated airport, docks with the airport and downloads the data it

Figure 1. 3DR Site Scan Capabilities (Source: https://3dr.com/features/).

has collected. Within a few years I believe that a system like this will be deployed across agriculture. Farmers will be able to order a specific service and ask for the drone to access a particular paddock from a touch interface. The drone will automatically carry out the required work before going back to the automated airport. The drone can then either be refitted for other work on the same property, or moved on to another farm.

Figure 2. Airobotics Automated Drone Airport (Source: https://www.airoboticsdrones.com/).

In the longer term the vehicle towing the airport will be a driverless vehicle so that no humans are required to deliver the service. The farmer will be able to control access to the data. They will issue permissions to share the data with agronomists (or even competing agronomists who bid for the work), researchers, suppliers of fertilisers and chemicals (see applications under Big Data and Artificial Intelligence in later section within this paper).

This means development of a utility service that is easy to use and has the capacity to reduce the capital needed for multiple hardware requirements. The business model also centralises the need for technical support and provides redundancy in the system. If you only have one drone and it breaks down, you have a problem. If you are part of a cooperative with 30 drones than this is much less of an issue.

Summary

As drone technologies are built on top of components from the global supply chain for smartphones and tablets many of the underlying technologies are already at the industrialised/commodity stage. This makes the platform stable and well developed and means that we should see rapid advances in services over the next five years. Farmers should be on the lookout for applications that are easy to use and avoid being drawn into services and arrangements that lock them into a multi-year contract, or do not allow them ownership over their own data.

Big data and artificial intelligence

If we take the wider application of drones and the implementation of broadacre sensor systems, for example, what The Yield (https://www.theyield.com) is marketing, then the next five to ten years will see masses of more data being produced in broadacre agriculture. Big data is both the basis for AI and the reason we need AI to get value. Models are emerging for practical applications of AI. Some of these are simple; for example, AI is being used to power a phone application to help farmers spot disease in Cassava plants in Africa (https://www.wired.com/story/plant-ai/). One of the interesting facets of this application is that due to improvements in phone capabilities and machine learning applications, all of the processing for the application is done on the phone. No need for cloud storage or internet access for it to work in the field. In the development of many emerging technologies, applications often emerge from simple systems and the offerings become more and more complex and valuable as the underlying technologies improve. Along with those changes we get better at understanding what works and why, and customers come to be comfortable with what they are using, making the next step of adoption easier. Applications such as this Cassava plant disease recognition system are likely to develop further into applications that cropping farmers can use to make decisions on-farm in more complex environments and also to capture data that can be analysed by advisers.

At a more complex level the startup company Ceres Imaging has shown promise in using AI for applications that can identify problems with nutrition and disease in crops before they are obvious to human eyes (http://money.cnn.com/2017/12/14/technology/corn-soybean-ai-farming/index.html). This means that problems can be addressed before they either become more expensive or impossible to respond to. The system uses planes rather than drones but the concept is just as applicable to drone technology. The system is able to recognise changes for two reasons. First of all it records data on wavelengths that humans cannot see, and secondly it is able to recognise patterns that humans do not necessarily recognise. This is analogous to the Google AI that beat the world champion at Go (https://techcrunch.com/2017/05/24/alphago-beats-planets-best-human-go-player-ke-jie/). The AI made

moves that the humans did not understand. The great thing about that example is that it improved the play of the world champion in subsequent months. He was able to recognise new patterns and new ways of playing. The same is likely for AI that identifies patterns in agriculture. They will make us better farmers.

These systems are by no means perfect at this stage of their development. They will improve as time goes by as they are able to look at the data they have collected and examine and compare it to real world results. In a biological system this will take years to build up enough data. The systems will also improve as data from in-ground sensing systems can be tied to the aerial data. Networks of farmers using the same system will gain more value.

Summary

Artificial intelligence systems are still at the custom built/early industrialised part of technology development. However, they are built on top of a long history of research and huge investments are being made in lots of industries which should flow over into developments in agriculture. The value of applications will grow in time as we get more data over long periods of time. Farmers should look for applications and farmer networks that have value now or are at least break-even now, will grow in value as more data is available to them. Farmers need to ensure that they retain ownership of the data and the capacity to export it in a format that can be used by other applications.

Blockchain enabled systems

While all the attention in recent months has been on the Bitcoin bubble and investment frenzy (which should be avoided at all costs), the underlying technology of Bitcoin and other cryptocurrency is still a completely valid technology development. There are several emerging applications which show some promise.

Outside of agriculture, the Australian company Power Ledger has developed some interesting trading applications for renewable energy. These started by using the blockchain as a system to allow trading of renewable energy between small networks in housing developments and retirement villages. They are also trialling an application with cane growers in Queensland. They are now conducting trials with Origin Energy to use the system over the existing grid in Western Australia, which also includes water applications. What this means is that anyone could trade with anyone over the network using the blockchain technology to automate and verify the process and transfer funds, as demonstrated in Figure 3.

If you have an electric car and are five hundred kilometres from home, you can use your own energy to charge your car through a technology enhanced charging system.

The price of solar energy in particular has dropped dramatically over the last decade with large scale installations now cheaper than coal fired power stations. At low scale, the costs are still fairly high. The key to reducing these costs is to increase

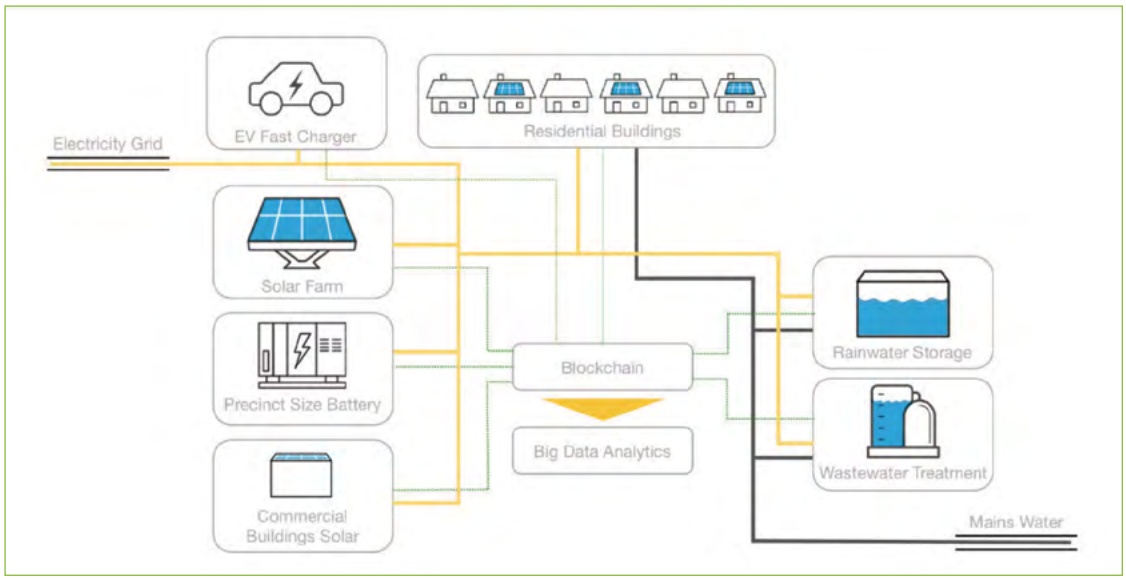

Figure 3. Power Ledger Fremantle project.

the size of installations. The sort of trading systems enabled by the Power Ledger initiative allow that to happen with a share ownership system, rights to a minimum percentage of the power generated, and an automate trading of any surplus. Opportunities will arise for agricultural operations to utilise land for larger scale systems that use this process.

Beyond that application there are two possible applications:

1. Models are already emerging for using the blockchain technology for the verification of high value products such as wine (https://cointelegraph.com/news/italian-wines-will-be-recorded-on-blockchain-authenticity-guaranteed) and fish (http://www.abc.net.au/news/2018-01-22/how-blockchain-is-being-used-to-combat-illegal-fishing/9344376). These are also being trialled as a food safety system for retailers (https://www.forbes.com/sites/rogeraitken/2017/12/14/ibm-walmart-launching-blockchain-food-safety-alliance-in-china-with-fortune-500s-jd-com/#2f76da77d9c5). Care needs to be taken about hyped up schemes as opposed to real applications, but it is likely that the applications will develop with the move to lower value of agricultural products.
2. Scope for the applications that have been developed for energy trading to be applied to grain trading. For example, if you are a producer of feed grain that you store on-farm you could trade a blockchain verified product with an end user such as a feedlot or a piggery. The specifications and price can be built into a smart contract which is traded in the marketplace, this is triggered on acceptance at the feed mill, based on the delivery meeting the volume and quality specifications. Money is transferred via the trading application and the ownership is only transferred once payment is received.

On a wider scale, if the trials that Power Ledger is carrying out with the energy grid are proven to be workable and economic, there is scope for the same sort of system to be applied across the whole grain network; placing more control and flexibility in the hands of the grower.

Summary

Blockchain technologies and applications are still in the idea/custom built stage of the technology arc. They are also attracting a large number of startups and some unscrupulous individuals. This means that there will be high levels of failure in the space over the next few years but what emerges has high potential for agriculture. Farmers should take a cautious approach unless they are high risk takers/early adopters, and only engage with reputable organisations and even so, be prepared for failure. Farmers will probably have to accept that the food chain will start to apply requirements on them for these sorts of technologies over the next five years.

The changing nature of the adviser

In my time in agriculture the nature of the adviser for cropping operations has changed. From a labour-intensive model of visiting farms at set intervals, the business model has evolved into one that uses technology to record crops on a more regular basis and targets physical visits to a need rather than the stage of crop development. Precision agriculture applications have further increased the level of data that is available. With the advent of drones and broadacre sensing systems, and the possibilities of blockchain based applications increasing the transparency of information throughout the supply change, we are on the verge of a seismic shift. The new paradigm will be defined by masses of data, increased transparency, increasing value of networks, and increasing use of AI. This means that the role of the adviser for cropping operations will alter. Some of the characteristics of that change will be:

- Developments of AI agents as, at least, partial advisers to farmers.
- Increased competition in the advisory services area as the pictures formed by data and our ability to share it anywhere in the world allow farmers to go further afield to look for services.
- Advisers with AI systems to assist them in their work.
- Increased activities in trading systems that require more specialised advice.
- Increased value of the adviser that can facilitate networks of farmers to get more from their data rather than being a font of knowledge.

Having said all of that, nothing replaces common sense, a strong personal knowledge of farming and business models that have a presence on the ground.

Summary

Farmers should be wary of technology and data led services that do not have a strong grounding in agriculture, and a local presence. Farmers should look to advisers to keep them informed on

new systems and technology. The ideal adviser is an independent one with a local presence and understanding, who has the ability to access a wider network of support, technology, and data services.

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Notes

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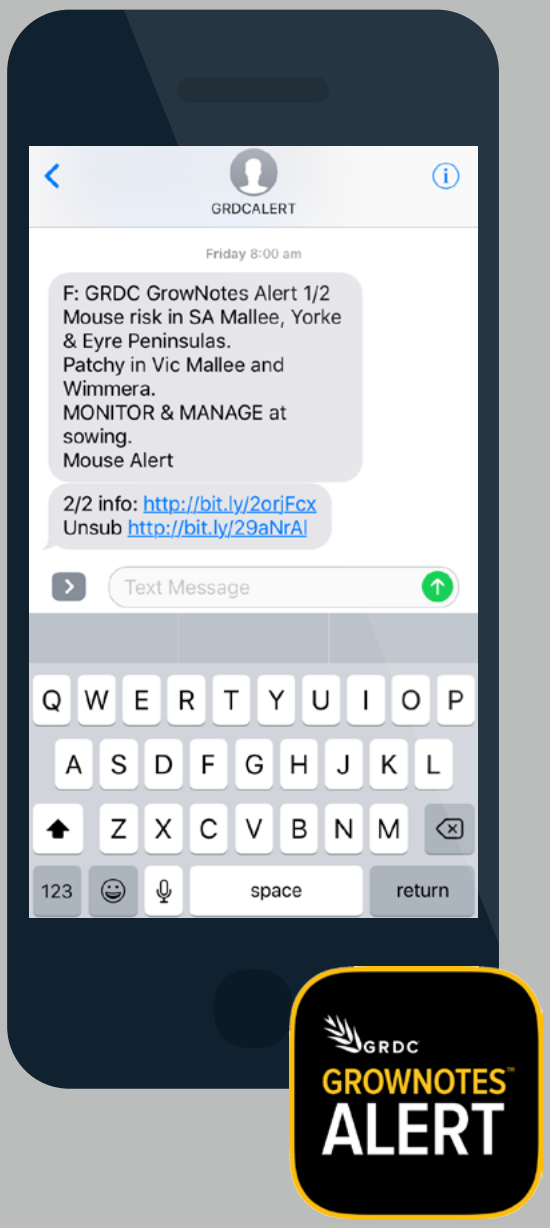

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AGRICULTURE VICTORIA

GRDC GROWNOTES ALERT

Measuring sustained profitability, allocating resources more efficiently and reducing financial risk

Phil O'Callaghan.

ORM Pty Ltd.

Keywords

- land values, return on capital, debt, equity, crop income, livestock, machinery cost, finance cost, financial risk.

Take home messages

- Victorian farmland 20 year investment return to 2016 was 9% per annum and includes a return on capital shown as land lease of 4% and capital growth of 5% as reported in Rural Banks Ag Answers May 2016. When compared to other investments this is very strong, suggesting farm land in Victoria has been a good investment option.
- Return on capital now averages 2-3% due to land values increasing faster than profits.
- Australian wheat cost of production five year average of $169 per tonne is 9% higher than overseas producers.
- The loss years now impact overall average profit more than the good years.
- Financial risk reduces when high cost paddocks are not cropped.
- Income volatility can be reduced by enterprise selection, seasonal carryover (water or $$) and timeliness of operation.
- Machinery investment has increased faster than income and has resulted in labour efficiency.

Australia competing in a global market

Results from an international benchmarking study, GRDC project AAM00001 titled 'National and International Regional Crop Benchmarking Network', referenced at GRDC Groundcover Issue 133 March-April 2018, which in summary can be interpreted as follows:

- Australian wheat yields are lower than other countries.
- Our farm gate prices for wheat are relatively good.
- We have higher seasonal variation in yield.
- Our wheat gross margin per tonne is comparable to our competitors.
- Our production cost per tonne averages about $169/tonne for wheat. The international average is $155/t with Argentina being the lowest at $109/t.

Victorian Wimmera/Mallee historical performance

AgProfitTM long term data includes a 20 year continuous subset of North Western Victorian cropping businesses. Analysis of this subset is similar to results from other areas and indicates the following:

- Equity (Net Worth) for family farms has grown from $1.3 million in 1995 to $5 million in 2017.

- Land values have increased faster than farm profits, hence Return on Capital has reduced to an average of approximately 2% to 3%.
- Average business debt has increased to around $1.5 million in 2017.
- On average farm income has increased 2.6 times over the last 22 years to around $1 million, and is due to growth in land area and an increase in crop intensity.
- Cost of machinery, overheads and finance are rising faster than income.
- Cost of fertiliser, sprays and other inputs are now more efficient relative to income.
- Labour efficiency has resulted from extra machinery investment.
- The financial loss in low income years has tripled, and is the result of larger total expenditure when combined with seasonal volatility of income

Managing financial risk

A generation ago it was the profit in a good year that more than covered a loss in the poor year. Now the tripling of costs results in the size of a loss in the poor year being harder to manage and not recovered by the profit from a good year. As a result a large portion of these losses are converted into core debt, hence some of the debt increase is from trading losses.

Seasonal volatility impacts on yield hence income. If income reduces then costs are converted into losses which then becomes new debt. Farming systems that operate profitably in more years than not demonstrate lower income volatility and lower total costs per $ of income and their losses in 'tough' seasons are not as large hence debt from loss years is less.

The Top 20% for profit (before interest)

The Top 20% farms from the Victorian Wimmera/Mallee AgProfitTM data subset make an extra $62 per hectare profit and achieve profits in most years compared with the average grower within this data subset. Hence for a 2,000 hectare farm there is $124,000 extra to spend on equity growth, debt reduction, capital replacement, land acquisition and lifestyle or family choices.

The profit drivers are a combination of attention to detail, timeliness of operation, cost control and efficient resource use. Extra profits can be the result of:

- Flexible management between seasons for crop area (intensity) and enterprise mix.
- Focusing the dollars where the return is best. For example, extra fertiliser and weed/pest control on best paddocks.
- Machinery costs is less per hectare both for operating and capital.
- Labour is doing more with less, i.e. machinery efficiency drives labour efficiency.

Less can be best

If profit is impacted by high costs and volatile income, then a farming system that achieves the same profit with lower costs and less fluctuation of income will be 'best'.

Farm managers are dealing with a range of variables specific to each individual farm. These variables influence which is the best farming system for that business and include variables such as soil moisture holding capacity, soil fertility, problem weeds and pests, herbicide resistance, and climatic factors such as frost or heat. Profits are about managing these variables to achieve the best outcome.

It may be that a reduction in crop area (intensity) can achieve similar profits with a lower financial risk. This can be illustrated as follows:

- Reduce crop intensity to 75% to 80% by dropping out of crop in one in four paddocks. This is achieved by selecting the high cost per hectare paddocks and/or the high income variability paddocks and choosing not to crop them.
- Utilise the 20% to 25% non-crop area to control problem weeds and build fertility.
- Cropped paddocks will increase their yield by on average by 10% (through moisture carry over and/or less weed competition).
- Costs per hectare of crop will reduce by 15% on average.
- Livestock can be introduced to utilise the 25% non-crop area. Livestock profit will improve overall profits to be higher than the 100% cropping system.
- If there is surplus machinery and labour then income from contracting can be considered.

- Less crop hectares can reduce stress, improve timeliness and enhance lifestyle.

Summary

Australian broad-acre cropping land is historically a **great** investment.

Victorian land values have a 20 year annual capital growth of 5.0%.

Making farm profits is influenced by:

- Volatile income due to seasons.
- $ spent has tripled which equates to large losses in low income years.
- Debt has tripled, the cost impact has been buffered by low interest rates.

Top 20% group make consistent profits (most years).

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Problem, purpose, passion and persistence – a start-up founder's journey

Naomi Stuart.

FARMpay.

Keywords

- nnovations, start-ups, agriculture.

Take home messages

- The best agriculture innovations will come direct from farmers and those actively engaged in agriculture as they understand the industry.
- Start with the problem – what problem are you trying to solve though your platform, product or service?
- Validate, validate, validate – get out and speak to your customers. This ensures that you are building a product that is fit for purpose.
- What is your purpose? – A clearly defined purpose will help you stay focussed.
- Embrace failure – and learn from it.
- Resilience – build professional, personal and physical resilience.
- Start-ups need access to capital, peers, mentors, corporates for pilots and working spaces.

The FARMpay journey

From a farming family, FARMpay's founding team has lived the experience of many grain growers; selling a large amount of grain with payment delayed for months and limited transparency over the grain supply chain. The industry standard for payment of on-farm grain sales is 30+ days. This current process is inefficient for growers, traders and buyers:

- Lack of transparency over the supply chain and manual processing of data causes transaction delays.
- Contract management is fragmented leading to poor logistics management.
- Delayed payment leads to cash-flow and risk management challenges for traders and growers.

In December 2016, the FARMpay founders embarked on an innovation journey which has taken them from regional Australia to Silicon Valley, Israel, China and beyond.

Combining a strong understanding of the issues faced by all parties and extensive knowledge of the agribusiness sector, the FARMpay platform was developed to provide a better way to manage on-farm grain sales.

FARMpay is a supply chain management platform that provides real time transfer of data and rapid payment for on-farm grain sales. FARMpay provides a more efficient, equitable, transparent and secure process for grain growers, traders and buyers involved with the selling of grain.

Key trends

1. Artificial Intelligence
2. Robotics
3. Internet of Things
4. 3D Printing
5. Blockchain
6. Bio-hacking

Key grants and assistance available

- Jobs for NSW – Minimum Viable Product and Building Partnerships grants. www.jobsfornsw.com.au
- Accelerating Commercialisation – www.business.gov.au/assistance/entrepreneurs-programme/accelerating-commercialisation
- R&D Tax Incentive - www.business.gov.au/assistance/research-and-development-tax-incentive

Agri-tech incubators and accelerators

- GrowLabs at Cicada Innovations - www.cicadainnovations.com/growlab/
- The Gate - www.thegate.org.au
- SparkLabs Cultiv8 - www.sparklabscultiv8.com
- SproutX - www.sproutx.com.au
- Charles Sturt University AgriTech Incubator - www.innovate.csu.edu.au/incubators/agritech
- SheStarts - www.shestarts.com
- Sydney School of Entrepreneurship - https://sse.edu.au

Conclusion

The agriculture sector continues to see the emergence and adoption of new technology that can create efficiency, improve productivity, reduce risk and increase profitability. Encouraging and supporting new innovation and start-ups provides benefits for the agriculture sector and broader economy.

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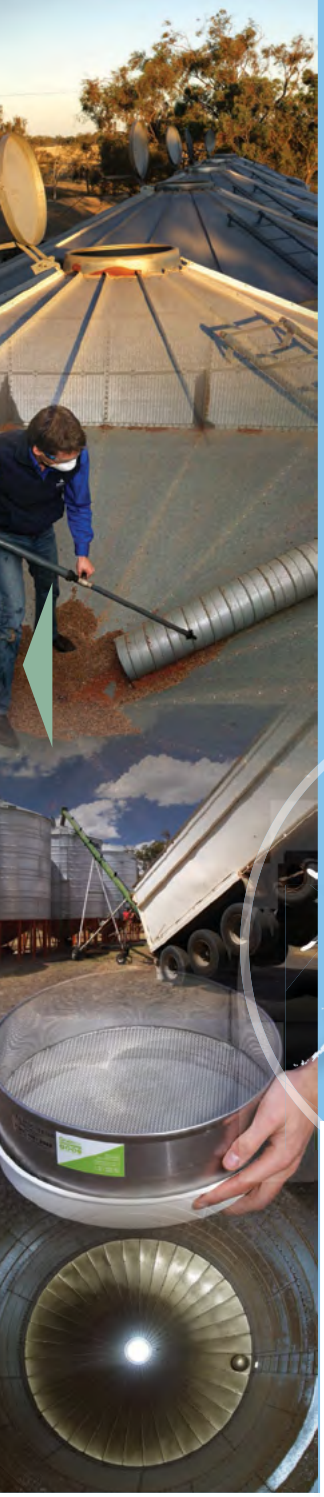

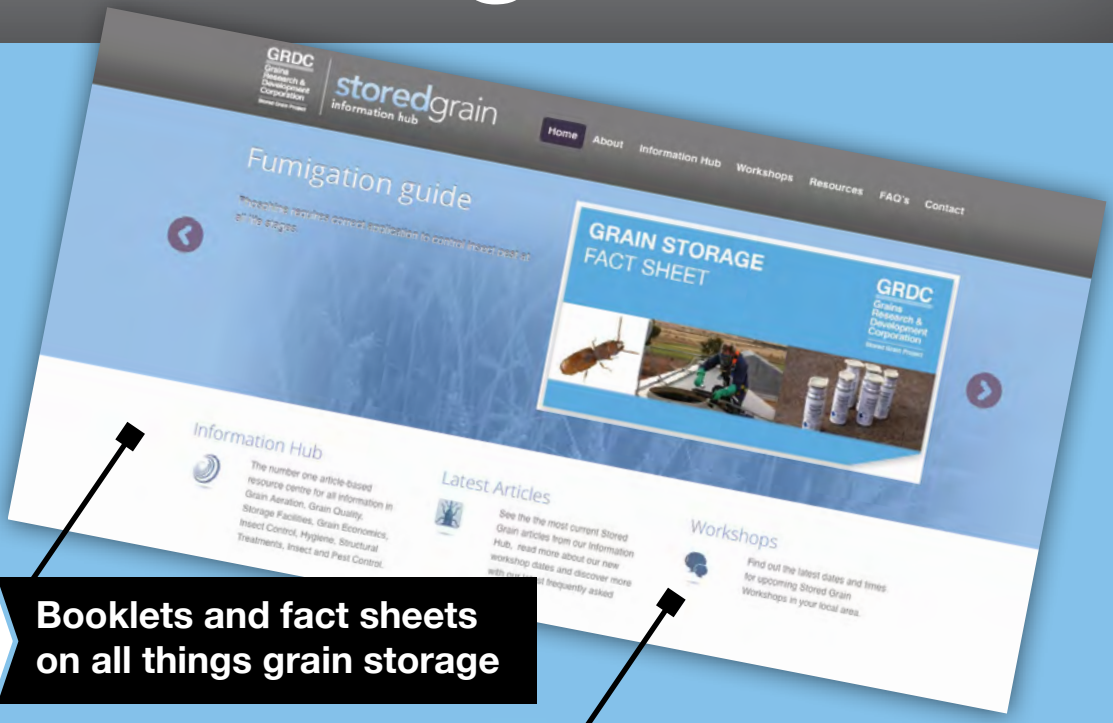

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Succession planning – start now

Nigel McGuckian.

Former partner, RMCG.

Keywords

- succession planning, progression planning, human resource management, business decisions, farming families.

Take home messages

- Succession planning must be seen as an ongoing process of high-quality human resource management.
- Rewards and responsibilities must be clear for every person in the business.
- Contribution of capital must be rewarded in a clear and transparent way.
- By rewarding for labour, capital and risk, people can be involved in the business in a range of ways. This leads to a flexible and fair approach to succession.
- This approach applies to any business and is essential in farming businesses.

Introduction

Since I began consulting in 1987, I have been involved in assisting farming families with succession in a range of ways. This involved family meetings, business analysis, writing buy/ sell agreements and developing succession plans. After about five years, together with my business partners we began planning an approach to succession at RMCG. In 2008 my wife and I sold our equity in RMCG, and I have now retired from RMCG. RMCG now have five directors and 15 employee shareholders. If we apply the same principles to succession for farming families, we can help farming families develop a sound, logical, process for succession. This paper describes how we managed succession at RMCG and how this applies to family farms.

Succession at RMCG

RMCG has been operating since 1989. Rob Rendell and I were the original owners. We employed an office manager. After about four years, we employed other people part-time, then full-time, then sold 50% of the business to two of the employees. Since then new partners have bought into the business and three partners have sold their share. I believe we have successfully enabled people to join the business and leave the business with minimal disruption and a fair deal for everyone along the way. Currently a number of ex-partners work in the business as employees.

The three basic principles we applied were:

1. Everyone in the business knows their role and responsibility clearly and is rewarded accordingly.
2. The capital contributed or used by the business (in the case of RMCG, the buildings) are rented from the owners of the capital.
3. After everyone is rewarded and the capital is rented, the profit is distributed based on an individual's share of ownership of the business.

I will try to describe how this works.

Clear roles and responsibilities and rewards

All employees are paid a salary based on 50% of budgeted fees plus a share of 10% of the profit. Every employee has an employment agreement and there are clear and transparent processes and expectations of both employees and employers.

Renting of capital

The buildings we use are owned by a range of people. The building in Bendigo is owned by a mixture of partners and employees in a property trust. This building is rented by RMCG from the property trust. The other buildings are owned by people I have never met but we have clear rental agreements.

Profit distribution

After payment of salaries to all staff and partners and reward for management, the remaining 90% of the profit is split based on the share of ownership.

There is nothing new, clever or revolutionary about these three principles. However, over the years, I have worked with many farming businesses and dealt with where they have come to after breaking these rules. This leads to conflict and sometimes break down of the business.

Succession on farms

Now let us apply these principles to a family farming business.

Roles and responsibilities

Everyone in the business must understand their roles and responsibilities and be rewarded appropriately. Therefore, whether it's a casual contractor, a family member working when they are home from school, one of the business owners or a family member 'doing the books', they must have a clear definition of the roles and responsibilities and be rewarded appropriately. This is essential.

Some farmers believe this is difficult for a variety of reasons. For example 'we can't afford to pay the boy/girl' or 'their role is too hard to define'. I maintain it is too important to ignore and it is the start of the rot.

The most important activity in human resource management is the 'staff review'.

At RMCG, staff reviews are conducted three times per year. It's part of the quality systems. I was surprised recently when presenting to a group of young people in horticulture, out of 25 people none of them had been involved in a staff review in the past 12 months. The staff review is an opportunity to discuss the person's aspirations, performance, rewards and training. The staff review is an important part of succession planning because it regularly provides an opportunity to discuss openly and honestly the person's roles, responsibilities and aspirations. These conversations form the basis of the discussions about becoming an owner in the business.

Good human resource management is also essential to ensure everyone in the business is safe, satisfied and is likely to believe they have a future in the business.

The following diagram shows the levels of roles and responsibilities at RMCG. Everyone understands these roles and everyone can be involved in discussing movement up or down through Figure 1.

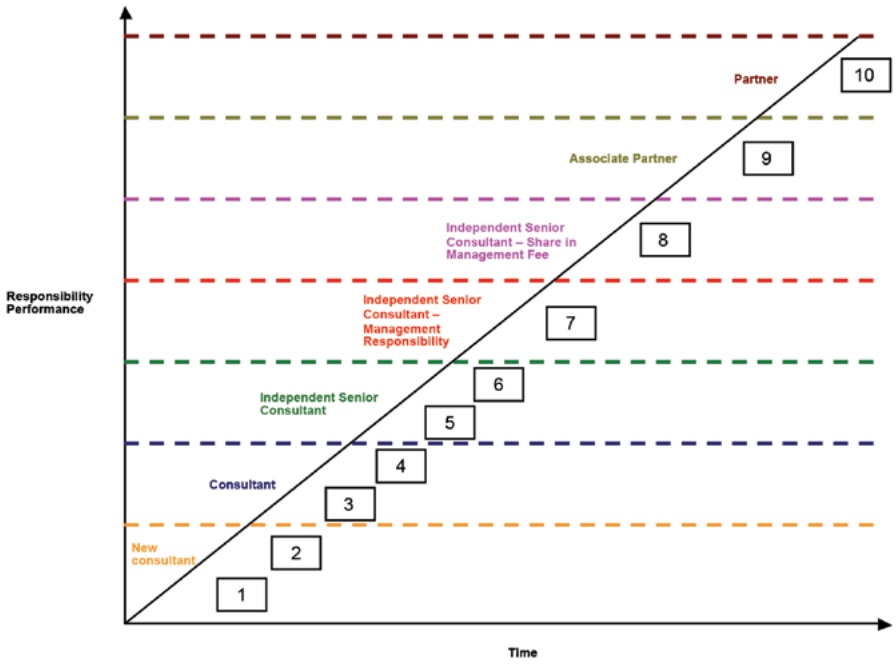

Figure 1. Possible roles and responsibilities within the RMCG business.

The award for farm hands has eight levels. It describes roles and responsibilities for people just entering the business through to manager level. This provides a useful guide to discussing roles and responsibilities.

Renting capital

The major capital employed in a farming business is the land. I argue strongly that the owners of the land must apply a rent to that land and that rent is paid. (If it is not paid it is still important to do the calculation). The amount of rent may be negotiable, however it is important to recognise that owning capital has an opportunity cost. This ensures that when the ownership of capital is uneven, the owners of the capital are rewarded appropriately. This also allows family members or non-family members to purchase land and rent it to the farming business.

Distribution of profit

The value of the operating entity in many farming businesses, particularly a grain business, is the value of the stock, plant and grain on hand. The operating entity takes the risk and the return on business capital should reflect the risk the business is taking. I have analysed a number of successful farming businesses over 10 to 20 years and although these are very good businesses with an average return on business capital between 15 and 25% after all wages, payment to owners and rent on land is paid. This attractive investment, is however risky.

By adopting the principles outlined above as we did at RMCG, someone coming into a farming business can see a pathway and a mechanism to enter the business, increase their responsibilities and rewards, and then invest in the business in a way which is rewarding. Before coming into the business, people will know and understand that they will always be rewarded appropriately, have an opportunity to purchase land, and may have an opportunity to purchase into the operating entity depending on their performance. This, I believe is highly motivating, transparent and fair.

The most common objection or question which is asked after I explain these principles is – 'we can't afford it' or 'how can we afford it?'

My response is – 'if you can't afford it, can you afford succession planning?'

By definition, if a business can't afford to reward people appropriately, pay an opportunity cost on capital, and reward risk appropriately, then can it afford to be in business?

For any business to succeed it must have high quality human resource management processes and it must be profitable. The human resource management processes can be fixed, if the business doesn't have a strong track record of profitability what options are there?:

- The first option is to sell the business.
- The second option is to discount the rent on land. This can be fairly applied if the owners of the land believe their capital gain makes up for the rent they are losing.
- The third option is to not reward people properly. Unfortunately, this seems to be a popular option. My experience is that this leads to disharmony, breakdown of relationships, misunderstandings and then people sell or leave the business.

So, consider if your business is rewarding everyone, and if not, start now.

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Notes

Grain storage – get the system and the economics right

***Peter Botta*[1,2].**

[1]PCB Consulting; [2]Grain storage specialist for the Southern Region GRDC Grain Storage Extension Project.

GRDC project code: PRB00001

Keywords

- grain storage, economics, costs, benefits, comparison.

Take home messages

- Planning for a storage system is vital to ensure growers can meet current and future needs, a system must be 'fit for purpose', to enable growers to outload a quality product and maximise their investment.
- The cheapest form of storage will be the one that suits your system, the grain being stored and the length of time it's stored.
- Permanent on-farm storage is a 25+ year investment – it's worth taking the time to do the numbers, consider the options and make informed decisions.
- Managing the storage system requires a systematic approach, a range of tools can and need to be implemented to enable success.

Background

As growers continue to expand on-farm grain storage, the question of economic viability gains significance. There are many examples of growers investing in on-farm grain storage and paying for it, in one or two years because they struck the market at the right time, but are these examples enough to justify greater expansion of on-farm grain storage?

The grain storage extension team conduct approximately 100 grower workshops every year throughout Australia and it's evident that no two growers use on-farm storage in the exact same way. Like many economic comparisons in farming, the viability of grain storage is different for each grower. Depending on the business's operating style, the location, the resources and the most limiting factor; the requirement to increase profit, grain storage may or may not be the next best investment. For this reason, everyone needs to do a simple cost benefit analysis for their own operation. When comparing systems and thinking about investment decisions, growers need to consider their ultimate goal with a view to the future, and be sure that the system they settle on will actually allow them to do what they need and what the market requires. The common mistake made when grain storage is purchased is whether or not it is fit for purpose. This is particularly the case where storage is purchased with the intention to fumigate and when aeration is added to an existing system or purchased with new storage.

Essentially a systems approach to grain storage includes grain and system hygiene, insect control, grain quality control, grain insect eradication and monitoring. Achieving a good result in all of these areas may mean attention to detail in the case of hygiene, and for insect eradication having sealable gas-tight sealed storage is the only way to achieve this properly. The key to ensuring success relies on getting the planning right, getting the right information and knowing the investment will do what it needs to do.

Table 1. Cost-benefit template for grain storage

Financial gains from storage		Example $/t	$/t	$/t
Harvest logistics/timeliness	Grain price x reduction in value after damage % x probability of damage %	$16		
Marketing	Post harvest grain price - harvest grain price			
Freight	Peak rate $/t - post harvest rate $/t	$20		
Cleaning to improve the grade	Clean grain price - original grain price - cleaning costs - shrinkage			
Blending to lift average grade	Blended price - ((low grade price x %mix) + (high grade price x %mix))			
Total benefits	Sum of benefits	**$36.20**		
Capital cost	Infrastructure cost / storage capacity	$155		
Fixed costs				
Annualised depreciation cost	Capital cost $/t / expected life of storage eg 25yrs	$6.20		
Opportunity cost on capital	Capital cost $/t x opportunity or interest rate eg 8% / 2	$6.20		
Total fixed costs	Sum of fixed costs	**$12.40**		
Variable costs				
Storage hygiene	(Labour rate $/hr x time to clean hrs / storage capacity) + structural treatment	$0.23		
Aeration cooling	Indicatively 23c for the first 8 days then 18c per month /t	$0.91		
Repairs and maintenance	Estimate eg. capital cost $/t x 1%	$1.51		
Inload/outload time and fuel	Labour rate $/hr / 60 minutes / auger rate t/m x 3	$0.88		
Time to monitor and manage	Labour rate $/hr x total time to manage hrs / storage capacity	$0.24		
Opportunity cost of stored grain	Grain price x opportunity or interest rate eg 8% / 12 x No. months stored	$7.20		
Insect treatment cost	Treatment cost $/t x No. of treatments	$0.35		
Cost of bags or bunker tarp	Price of bag / bag capacity tonne			
Total variable costs	Sum of variable costs	**$11.32**		
Total cost of storage	Total fixed costs + total variable costs	**$23.72**		
Profit/Loss on storage	Total benefits - total costs of storage	**$12.48**		
Return on investment	Profit or loss / capital cost x 100	**8.1%**		

Comparing on-farm grain storage

To make a sound financial decision, we need to compare the expected returns from grain storage versus expected returns from other farm business investments, such as more land, a chaser bin, a wider boomspray, a second truck or paying off debt, etc. The other comparison is to determine if we can store grain on-farm cheaper than paying a bulk handler to store it for us.

Calculating the costs and benefits of on-farm storage will determine a return-on investment (ROI) figure, which can be compared with other investment choices and a total cost of storage to compare to the bulk handlers.

Cheapest form of storage

The key to a useful cost–benefit analysis is identifying which financial benefits to plan for and costing an appropriate storage to suit that plan. People often ask, 'what's the cheapest form of storage?' The answer is the storage that suits the planned benefits. Short term storage for harvest logistics or freight advantages can be suited to grain bags or bunkers. If flexibility is required for longer term storage, gas-tight, sealable silos with aeration cooling allow quality control and insect control.

Benefits

To compare the benefits and costs in the same form, it is necessary that you work everything out on a basis of dollars per tonne. On the benefit side, majority of growers will require multiple financial gains for storing grain to make money out of it. These might include harvest logistics or timeliness, market premiums, freight savings or cleaning, blending, or drying grain to add value.

Costs

The costs of grain storage can be broken down into fixed and variable. The fixed costs are those that don't change from year to year and have to be covered over the life of the storage. Examples are depreciation and the opportunity or interest cost on the capital. The variable costs are all those that vary with the amount of grain stored and the length of time it's stored for. Interestingly, the costs of good hygiene, aeration cooling and monitoring are relatively low compared to the potential impact they can have on maintaining grain quality. One of the most significant variable cost and the one that is often overlooked is the opportunity cost of the stored grain. That is, the cost of having grain in storage rather than having the money in the bank paying off an overdraft or term loan.

The result

Table 1 can be used to figure out the likely economic result of on-farm grain storage for each individual business. Each column can be used to compare various storage options including type of storage, length of time held or paying a bulk handler.

While it's difficult to put an exact dollar value on each of the potential benefits and costs, a calculated estimate will determine if it's worth more thorough investigation. If we compare the investment of on-farm grain storage to other investments and the result is similar, then we can revisit the numbers and work on increasing their accuracy. If the return is not even in the ball park, we've potentially avoided a costly mistake. In contrast, if after checking our numbers the return is favourable, we can proceed with the investment confidently.

Summary

Unlike a machinery purchase, grain storage is a long term investment that cannot be easily changed or sold. Based on what the grain storage extension team are seeing throughout Australia, the growers who are taking a planned approach to on-farm grain storage and doing it well are being rewarded for it. Grain buyers are seeking out growers who have a well-designed storage system that can deliver insect free, quality grain without delay.

Useful resources

For more information or advice on grain storage or to download a copy of the cost benefit analysis booklet and spreadsheet, contact the grain storage extension team via www.storedgrain.com.au

Economics of on-farm grain storage booklet and spreadsheet http://storedgrain.com.au/economics-booklet/ (Table 1 within this paper)

On-farm grain storage checklist http://storedgrain.com.au/storage-checklist/

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Notes

Utilising spatial data for within-paddock soil and crop management

Andrew Whitlock.

Precision Agriculture P/L.

Keywords

- zonal management, within-paddock variability, variable rate, precision agriculture, NDVI imagery, grid soil mapping, yield maps, EM-38.

Take home messages

- A flexible approach is required when developing zonal management plans. Multiple tools are available to help define within-paddock variability, yet no one tool can do it all.
- Explore opportunities to unlock yield potential by addressing any known soil constraint/s. Soil zones are generally stable and easy to define. Common applications include variable rate lime and gypsum, and management of waterlogging with paddock design and strategic drains.
- Focus on site-specific crop management once a healthy soil base has been established. Management zones for variable rate fertiliser, fungicides, weedicides, pesticides and growth regulants will typically vary between seasons. They may or may-not align with your soil zones. Appropriate selection of data, farmer knowledge and careful ground-truthing is the key to a successful variable rate program.
- Continue to challenge your farming system and management decisions with seasonal crop monitoring (normalised difference vegetation index (NDVI) imagery, yield maps, plant testing, etc.) and ideally couple with a coordinated on-farm trial program.
- Precision farming should not be difficult or confusing it should integrate seamlessly with your established farm management plan. A team approach with the farmer, agronomist and precision agriculture adviser delivers the best results.

Introduction

All farmers make observations of their soil and topography and assess the implication on yield to help inform how they manage a paddock. In addition, single sample or transect soil testing is commonly used. More advanced approaches may have included sap or petiole testing in-crop for nutrient management. In recent years we have had increasing access to low-cost spatial data which can enable variable rate soil and crop management (i.e. yield, imagery, soil conductivity, topography and soil tests). While not yet perfect, we have seen advancements in the useability, interoperability and connectivity of precision farming hardware.

Yet despite these developments the adoption of variable rate management remains incredibly low, especially in South Eastern Australia. Lack of technical support to assist farmers with this management approach (hardware, software and agronomics) and perception of low return on investment are just a few known barriers to adoption.

Sub-optimal allocation of inputs (potential lost opportunity for both input savings and yield increase) and missed opportunity to resolve variable soil constraints remains an issue for many paddocks with a paddock scale management unit approach.

There is a range of tools that can inform or define paddock variability. The applicability of the tool(s) used to define and describe within-paddock variability will be determined by the soil constraint or productivity issue that is being tested. Often a single layer of data may not define the issues and the treatment.

Common tools used to define and describe variability include:

- Yield data – can identify zones of variable productivity which warrant further investigation but will not identify factors that are constraining yield without additional knowledge and/or data. Yield data can also be used to determine nutrient removal maps (phosphorus is the most common nutrient to be managed with the influence of this data).
- Electromagnetic induction (EM-38 dual dipole) measures a combination of soil salinity, clay and soil moisture at depth (approximately 1.5m). For many paddocks it can provide an accurate soil map. Soil cores and associated analyses (ideally segmented cores to explore soil profile) are essential to extract paddock management value from such soil maps.

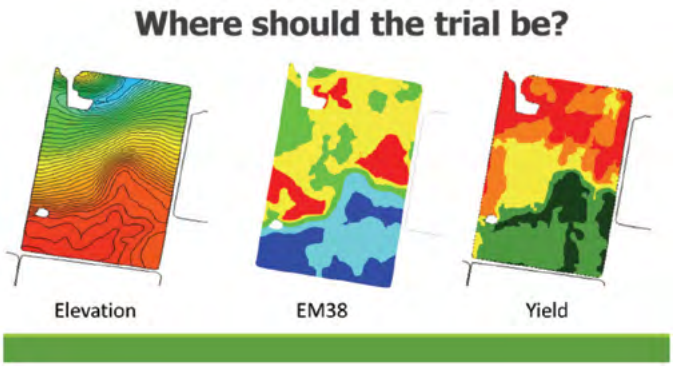

Figure 1. Maps from three data tools highlighting the value of integrating datasets for developing zones.

- Gamma radiometrics are another soil mapping tool used predominantly in combination with EM-38 on sand plains and in gravel soils where soil conductivity is less effective in isolation. It effectively measures the natural radioactive decay of potassium, thorium and uranium in the top 30cm to 45cm of the soil.
- NDVI provides an assessment of canopy density, biomass and plant vigour. NDVI will not define the underlying factor promoting or limiting plant growth, it simply indicates where to investigate (visual, plant testing, soil testing, etc.) and helps define boundaries around such factors. Multiple layers of data and or integration of existing paddock knowledge will be required to validate NDVI imagery. For example, nutrient imbalance would require additional soil testing to understand what is deficient, while suspected diseased crop would need to be tested to identify the pathogen and to prescribe a treatment.

  Satellite derived NDVI maps (30m to 30cm resolution) offer a low-cost whole-farm monitoring opportunity which can help benchmark paddock performance and assess management (i.e. detect uneven seeding or spreading, spray misses or uneven irrigation).

  Drones or unmanned aerial vehicles (UAVs) can provide similar services as a satellite but also have the flexibility to target timing and the area that is monitored. They offer a superior resolution (1m to 1cm) for more detailed insights into crop and even individual plant performance.

  From an active crop management point of view, NDVI imagery can inform the need for a range of activities including variable rate nitrogen (N), variable rate fungicide and crop growth regulants, strategic weed control (spray and/or cut for hay) and definition of seasonal yield constraints such as waterlogging, pests and sub-soil constraints.
- Global Navigation Satellite System (GNSS), in addition to machinery guidance underpins elevation mapping. This data can be converted into digital elevation models, informing water management such as drainage design, water logging zones, erosion control and water harvesting.
- Soil testing can define a broad range of soil physical, chemical, biological and hydraulic properties. Disease pathogen and nematode monitoring can be included in this process.

  Our understanding of economic response curves to a range of crop inputs links back to many years of research in soils with known chemical element concentrations. Farmers and agronomists utilise keys measures for management decisions such as Colwell phosphorus coupled with phosphorus buffering index (PBI) for phosphorus (P) applications and soil pH($CaCl_2$) coupled with crop sequence plan to determine a lime application rate. We can extend this thinking to how to develop an accurate variable rate management application in areas of the country where temporal yield variability is less consistent/predictable (i.e. anywhere other than low rainfall dune-swale systems).

We ideally want to use the same soil measurement from the input response research for developing variable rate management zones. This takes us to the most common method of paddock zoning in the world, grid soil mapping (soil transect sampling per grid unit, typically 1-4ha). The simplicity is appealing as we no longer rely on building assumptions around relationships between spatial datasets. A grid soil map can provide a baseline for several seasons (especially for farmers who can link nutrient removal maps via their yield data). Grid Colwell or Olsen P, pH($CaCl_2$) and exchangeable cations (potassium (K), sodium (Na), magnesium (Mg), aluminium (Al)) are the more common soil elements tested when grid soil mapping (0cm to 10cm).

Soil probes/sensors which assess soil elements in-situ are becoming increasing popular as they offer a lower cost per sample enabling greater sampling density. In our experience, these sensors struggle to generate accurate results across all soil types and moisture levels and thus it is essential to calibrate every paddock with traditional wet chemistry laboratory analysis.

When addressing within-paddock variability the highest return on investment (ROI) is often achieved by addressing the key soil health factor/s limiting crop performance. Soil acidity (VR lime) and sodicity (VR gypsum) are common strategies to ameliorate soil constraints and in doing so unlock yield potential. For example, the aim of the VR lime is to establish a minimum target pH level (i.e. pH($CaCl_2$) of 5.2) across the entire paddock, while avoiding issues associated with over-liming.

As the key soil constraints are ameliorated and broader measures of soil health are improved, site-specific crop management can be implemented. Seasonal management strategies (predominantly VR nutrition, disease and pest control) are developed with the combination of underlying soil levels (grid or zonal soil testing) and crop monitoring information (NDVI, yield maps and boots on the ground). Macro nutrient supply (predominantly N, P and K) via seeding and spreading are the most common VR strategies employed.

A note of caution must be applied when yield and or NDVI maps are solely used to define zones for VR management strategies. Plant growth and final yield is influenced by a multitude of factors, with the dominant influences being the key plant growth constraints for that particular season. Paddock knowledge is essential when interpreting yield and NDVI maps and such maps can be valuable in defining dominant constraints but rarely offer ability to map sub-clinical factors. For example, crop performance zones for a certain paddock may be great at defining severe sub-soil constraints (rooting depth/plant available water capacity (PAWC)) but do not accurately inform the variability of soil P and/or surface soil pH.

Lumpy capital investments (i.e. five yearly lime application costing +$200/ha) attract an interest in a VR approach as the immediate input savings (i.e. VR lime average saving of 30%) more than offset the cost of mapping, plus such jobs can be implemented by contractors with VR technology.

Other paddock mapping investments may be applied over several seasons such as a grid soil P map coupled with P removal (yield) maps. A quick evaluation of what a 15% input efficiency gain can

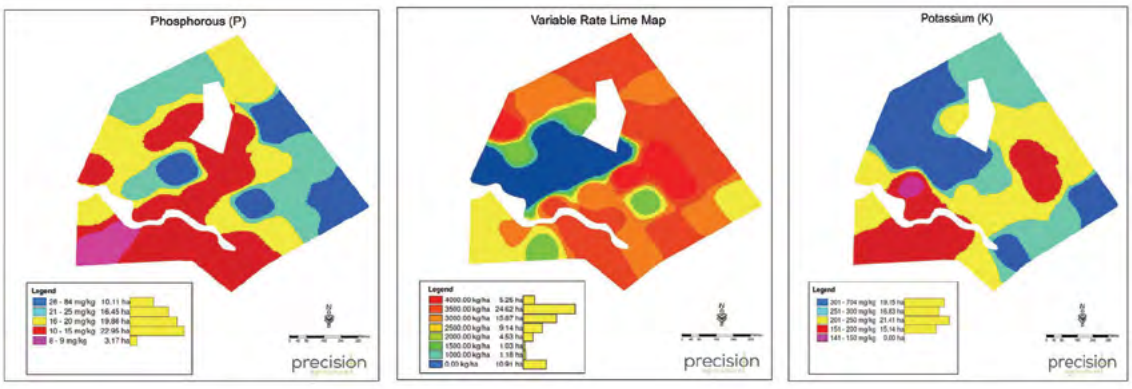

Figure 2. Comparison of results from 2ha grid soil mapping of 80ha paddock near Rokewood. Colwell P (left), variable rate lime prescription map (middle) and Colwell K (right).

help determine the likely ROI. For example P @ 80kg/ha x $680/t x 5yrs = $272/ha. 15% decrease in input cost = $40.80/ha. It can be difficult to model the extra income derived by improved P management (especially if areas of the paddock are P deficient), yet such value should be considered when evaluating the investment.

Conclusion

We are seeing an explosion of interest in ag-tech and we can expect to see a myriad of technologies hit the market in coming years. When evaluating the value of a sensor technology for your farm, start with a clear understanding of exactly what it is measuring and how this data can be converted into an action. A well-designed ground-truthing process must be employed when relying on surrogate datasets to determine VR application plans. Where possible link paddock mapping analysis with well-established science-based principles. In essence, precision agriculture is simply the intensification of an agronomic management decision. Secure partnerships with businesses who can support you with all steps of the VR management process: agronomy, data collection/processing and application.

Useful resources

Precision agriculture - common sense with a dash of technology

www.grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-58/precision-agriculture-common-sense-with-a-dash-of-technology

Variable-rate application of grain cropping inputs

www.grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2015/07/variable-rate-application-of-grain-cropping-inputs

References

www.precisionagriculture.com.au/variable-rate.php

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Notes

OFT Online Farm Trials

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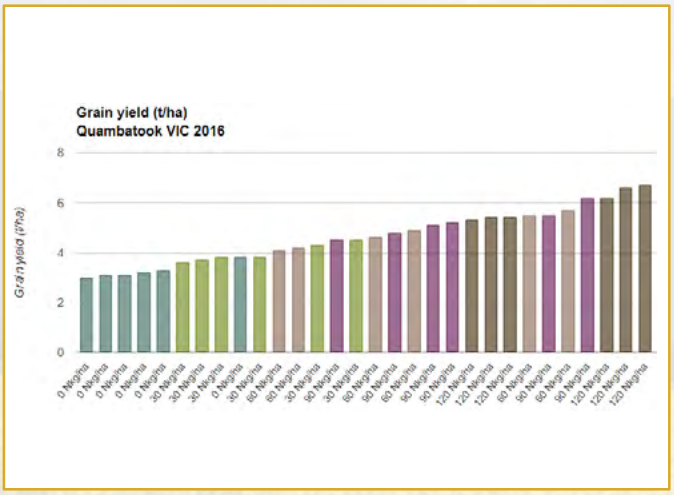
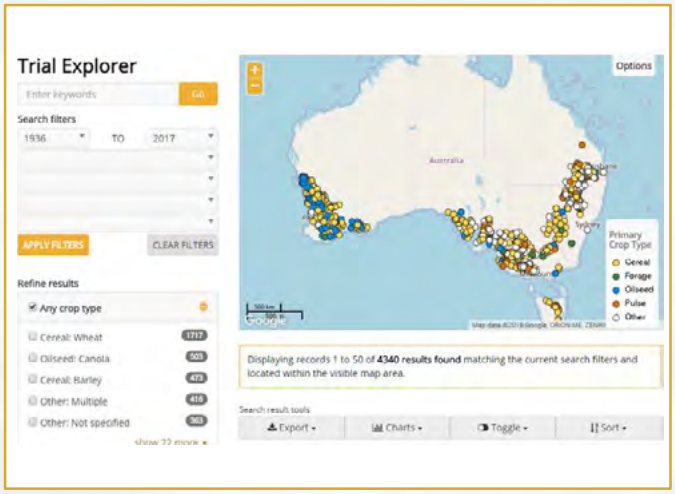
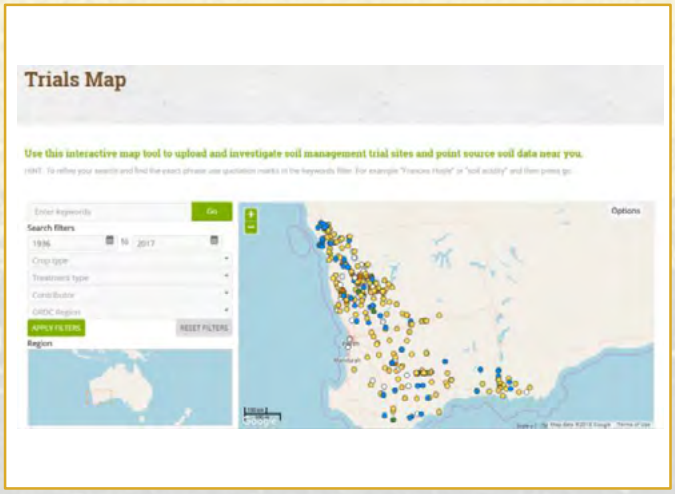
Looking for relevant and freely accessible information on issues such as crop nutrition, disease control or stubble management in your region? Online Farm Trials (OFT) contains over 4,700 on-farm trial projects from across Australia on a wide variety of crop management issues and methods. Use OFT to discover relevant trial research information and result data and to share your grains research online.





Grower and farming system groups, government researchers and industry are using OFT to manage and share their grains research online. Upload and publish your trial research data and reports to OFT to share information on solutions that address local or regional issues to increase profitability and sustainability of farming enterprises.

An embeddable version of the OFT Trial Explorer, or widget, has been designed for use on third-party websites. The widget provides the opportunity to display your trial project information on your own website and allows users to view other relevant trials from across Australia. Visit OFT for more information or to register an interest in managing your trial information with Online Farm Trials.



www.farmtrials.com.au/2018updates **@onlinefarmtrial**

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Leadership and generations

Jill Brigg.

Affectus P/L.

Keywords

- Autonomy, differences, transitions, communication, accountability, responsibility.

Take home messages

- Autonomy – explore this concept and create opportunity as this will hold people to your business.
- Difference adds value so ensure differences are acknowledged and included.
- Transitions – change is constant so skill up on knowing how to transit.
- Communication – incredibly important – practice and never short-change on communication.
- Responsibility and accountability – give responsibility so there will be a sense of needing to be accountable.

Introduction

This paper supports the presentation by Affectus Managing Director, Jill Briggs at the 2018 Bendigo GRDC Farm Business Update. This paper is not a transcript of the address, rather it is the materials that have informed the address.

There are five areas to be considered during this address:

1. Autonomy.
2. Difference.
3. Transitions.
4. Communication.
5. Responsibility and accountability.

These concepts will be addressed in relation to farming and my personal farming family experience will be drawn on to illustrate some of the concepts.

Disclaimer: This paper provides general information only, current at the time of production and researched by Affectus. Any advice in it has been prepared without taking into account your personal circumstances. You should seek professional advice before acting on any material.

Let's remember; we are all getting older . . . this is so important for farming businesses. Secondly, numbers are easy; people are complex, but we are going to discuss the complexity of people.

Autonomy

What is autonomy? Freedom from external control or influence; independence.

Stock and Forney (2016) who have studied famers and autonomy have identified that farmers describe autonomy as the equivalent of being one's own boss. They have also found that the value of autonomy for farmers and workers on farms was important and it held them to their job. Is this true when we consider the reality of farming? Being your own boss is incredibly important and possibly even more so when you consider for many in farming, control is something that can be limited – weather, pricing, finances...these are not always in the control of farmers but to be able to be autonomous about other aspects of the farming environment holds many to farming. As Stock and Forney discuss, this autonomy gives farmers a very strong sense of self that is tied to the enterprise.

For young people this is a great opportunity; to be autonomous and able to be in control of self. I have found that this is very important when I observe our three-generational farm. But there has been tension there also...allowing the younger generation to 'have a go' versus 'being careful'.

What are the questions we can ask ourselves and those working in our enterprise to assist with **autonomy**?

At a management level:

- Are you interested in working alone?
- How will I ensure that you are performing your role?
- What will the reporting back process look like?

At an operational level:

- Can you explain to me what the task is? – then I won't have to tell you what to do.
- Can you see how this fits in with all of the components of this task/business unit?
- What do you think needs to be done now, tomorrow, next week?

When this concept of autonomy is considered, leadership on this matter then needs to be undertaken. Who should take the lead on this matter and how will it impact the enterprise?

The leadership on this matter can be assisted by understanding Hersey and Blanchard (https://www.investopedia.com/terms/h/hersey-and-blanchard-model.asp).

Hersey and Blanchard framework can assist us with our process of providing autonomy. But you must commit to watching and understanding, whether you are the junior person or the senior person.

Analyse what a team and/or an individual need, which gives rise to four leadership styles (Table 1).

Table 1. Leadership styles within the Hersey and Blanchard model.

Telling	unable and unwilling
Selling	unable but willing
Participating	able but unwilling
Delegating	willing and able

Difference and its value

What are the differences that are often present in farming enterprises? Generational difference is the most common difference.

Looking at generational **difference**.

So, the great thing about our business is that there are three generations, and this creates tension and tension is ok, as long as communication is healthy and skilled. Difference is valuable for farming, it brings ideas and change. Difference is not evil.

There are many charts about generational differences and it is valuable to understand that these are not prescriptive, they are broadly descriptive.

Table 2. Generational differences in a snap shot.

Generation	Seniors	Boomers	Gen Xers	Gen Yers	Gen Zers
Born	1922 - 1945	1946 - 1964	1960 - 1980	1975 - 2000	1995 - 2009
Training	The hard way	Too much and I'll leave	Required to keep me	Continuous and expected	Playing Life
Learning style	Classroom	Facilitated	Independent	Collaborative and networked	Pocket mobile internet based
Communication	Top-down	Guarded	Hub and spoke	Collaborative	Electro-social, highly connected
Problem-solving	Hierarchical	Horizontal	Independent	Collaborative	Global Tribe / Independent
Decision-making	Seeks approval	Team informed	Team included	Team decided	Sonar / Individualistic
Leadership style	Command and control	Get out of the way	Coach	Partner	RSS Protagonist
Feedback	No news is good news	Once per year	Weekly/Daily	On Demand	Continuous social sonar
Technology use	Uncomfortable	Unsure	Unable to work without it	Unfathomable if not provided	Lifelong use
Job changing	Unwise	Sets me back	Necessary	Part of my daily routine	...

(Source: http://hobbycentralrc.com/raw/nugamoce/img1321670.jpg)

What are the questions we can ask ourselves and those working in our enterprise about generational **difference**?

At a management level:

- What generations are represented in our enterprise?
- How can we understand the differences so that they will be helpful rather than a hindrance?
- What blocks are clear from Table 2?
- What are the gifts that the different generations can give to each other?

At an operational level:

- This is how I learn – can we find a way to learn that works for us all and the business?
- How can we keep you interested and employed?
- When can we talk about how you are performing?

Transition and decision-making

Transition is about change, and therefore, we need to understand our responses to change.

Behaviours of change

Immobilisation -> Denial -> Incompetence -> Acceptance -> Testing -> Searching for Meaning -> Integration.

This is particularly important for the younger generation. We need to know how to assist those around us – particularly how to assist those around us who have built an 'empire' and continue to see their own vision. The questions that assist with people moving through the behaviours of change are illustrated in Figure 1.

What are the questions we can ask ourselves and those working in our enterprise **about transition and change**?

At a management level:

- What change is upon us and in the future?
- How have we dealt with change in the past? And how can we do it better in the future?
- How can we make the people in our enterprise feel comfortable about the changes?

At an operational level:

- This is what is happening – how can we get through this change?
- What is concerning you and how can we make it easier for you?
- When can we talk about your response to change?

Communication

What is the importance of communication? It is everything.

Figure 1. Questions to assist people moving through the behaviours of change (Source: https://joinclubsoda.co.uk/cycles-of-change/).

Small businesses have enormous opportunity to communicate effectively due to the lack of encumbrances of large organisational structures and processes. The essence of communication is about ensuring the following elements are considered: -

- Minimise power imbalances.
- Ensure you can hear each other.
- Listening is the most important element.
- Feedback loops need to be present.
- Technology is helpful and can be a hindrance.
- Suspending judgement.

Figure 2 illustrates how communication happens.

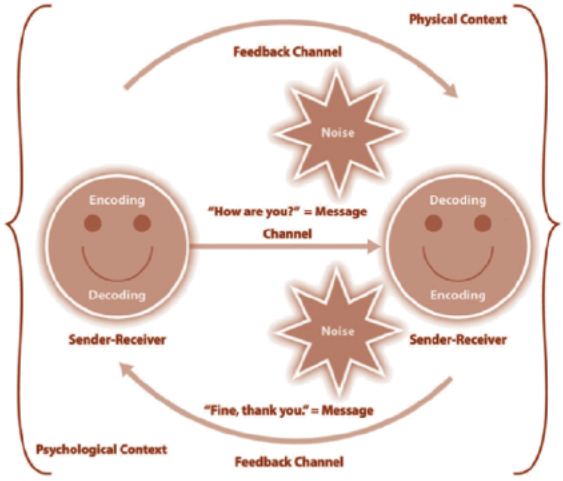

Figure 2. Illustration of the essence of communication.

Accountability and responsibility

The cycle illustrated in Figure 3 can be used in developing your ideas and seeing them through.

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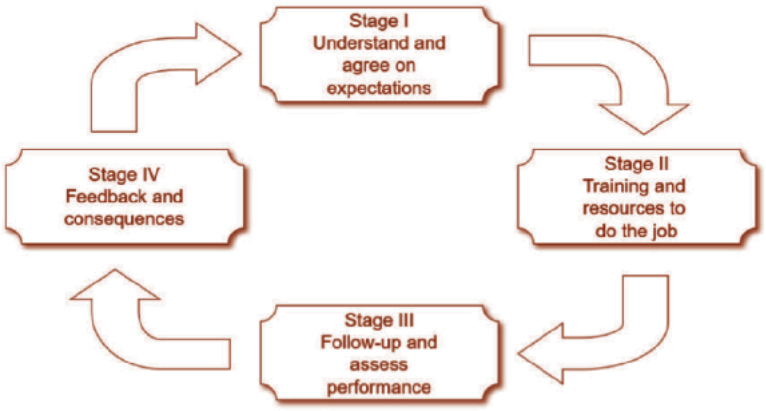

Figure 3. Illustration of stages from developing an idea through to making it happen (Source: http://library.cdsconsulting.coop/wp-content/uploads/accountability.jpg).

Notes

Notes

Fatigue prevention

John Toomey.

The Fatigue Prevention Company.

Keywords

- fatigue, oxygen, sleep, engagement.

Take home messages

- Create high productivity, low risk, and positive culture workplaces.
- Increase productivity across the board.

Background

Workplace fatigue costs lives and it costs money. Fatigued workers:

- Are less able to concentrate on tasks.
- Have a reduced capacity to make decisions.
- Make more mistakes.
- Struggle to feel motivated.
- Are more likely to use dangerous stimulant drugs.
- Are more likely to be involved in or create conflict.
- Are more likely to miss shifts and take 'sickies'.
- Have a higher likelihood of traffic accidents when driving, especially post shift.
- Need greater supervision and direction.

The benefits of learning how to mitigate fatigue

The benefit of learning how to prevent fatigue include:

- Fully engaged people which contribute to their work and personal life.
- Shifting attitudes and changes in behaviour.
- Creation of a new, exciting and ongoing culture of self-care and care for team mates and family.

Education about the many causes of fatigue, and how and why those things cause fatigue enable you to avoid common issues.

Understanding simple and clear tips as to what can be done to prevent those causes inspires a willingness to create change for the benefit of all around you.

Implement the first steps that produce palpable results, which leads to the motivation to take more steps.

Causes of fatigue

What causes daytime or wake time fatigue? Is it poor sleep? Perhaps it is, but how does one explain incessant yawning, drowsiness and lethargy during a day following an eight or nine hour sleep? Fatigue is a multi-faceted challenge and requires understanding and knowledge to ensure that it can be kept at bay, or even eliminated. Energy drinks and stimulants are not a good answer. Over time, these may well have a negative impact on the health of the body, leading to additional problems, and possibly more fatigue. Energy drinks and other stimulants, in a hot climate can increase the risks of heatstroke, workplace accidents and death.

Learning to manage fatigue

Begin to educate, inspire and empower your people to gain mastery over fatigue to reduce risk, workplace presenteeism and absenteeism, and to improve productivity, enthusiasm, culture and enjoyment of life. It is important that employees go home at the end of the day, and when they do go home, have energy to engage with their families and play with their kids.

The key to combatting fatigue is within our human physiology and the importance of fully oxygenated blood flowing to the brain at optimum rate and volume. When oxygen delivery to the brain is compromised, fatigue quickly sets in. There are two factors that commonly cause fatigue; low oxygen saturation in the blood and sub-optimal blood volume and there are many triggers that influence these two factors.

Most people battle through the effects of fatigue daily, then blame workload, not enough sleep or stress. Mental fatigue is a common problem that is not well understood, yet easily overcome.

Sleep is also a key factor that needs to be addressed. Some people need four hours per night whereas others need nine hours. And some spend nine hours in bed and sleep for less than four hours. Many things can compromise sleep quality. Did you know that snoring and sleep apnoea can both be rectified within two to three weeks?

Conclusion

Some simple strategies implemented into your daily routine can become a powerful and life changing force in combatting daytime fatigue.

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Notes

THE 2017-2019 GRDC SOUTHERN REGIONAL PANEL

FEBRUARY 2018

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

CHAIR - KEITH PENGILLEY

Based at Evandale in the northern Midlands of Tasmania, Keith was previously the general manager of a dryland and irrigated family farming operation at Conara (Tasmania), operating a 7000 hectare mixed-farming operation over three properties. He is a director of Tasmanian Agricultural Producers, a grain accumulation, storage, marketing and export business. Keith is the chair of the GRDC Southern Regional Panel which identifies grower priorities and advises on the GRDC's research, development and extension investments in the southern grains region.

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DEPUTY CHAIR - MIKE MCLAUGHLIN

Mike is a researcher with the University of Adelaide, based at the Waite campus in South Australia. He specialises in soil fertility and crop nutrition, contaminants in fertilisers, wastes, soils and crops. Mike manages the Fertiliser Technology Research Centre at the University of Adelaide and has a wide network of contacts and collaborators nationally and internationally in the fertiliser industry and in soil fertility research.

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JOHN BENNETT

Based at Lawloit, between Nhill and Kaniva in Victoria's West Wimmera, John, his wife Allison and family run a mixed farming operation across diverse soil types. The farming system is 70 to 80 percent cropping, with cereals, oilseeds, legumes and hay grown. John believes in the science-based research, new technologies and opportunities that the GRDC delivers to graingrowers. He wants to see RD&E investments promote resilient and sustainable farming systems that deliver more profit to growers and ultimately make agriculture an exciting career path for young people.

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PETER KUHLMANN

Peter is a farmer at Mudamuckla near Ceduna on South Australia's Western Eyre Peninsula. He uses liquid fertiliser, no-till and variable rate technology to assist in the challenge of dealing with low rainfall and subsoil constraints. Peter has been a board member of and chaired the Eyre Peninsula Agricultural Research Foundation and the South Australian Grain Industry Trust.

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FIONA MARSHALL

Fiona has been farming with her husband Craig for 21 years at Mulwala in the Southern Riverina. They are broadacre, dryland grain producers and also operate a sheep enterprise. Fiona has a background in applied science and education and is currently serving as a committee member of Riverine Plains Inc, an independent farming systems group. She is passionate about improving the profile and profitability of Australian grain growers.

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JON MIDWOOD

Jon has worked in agriculture for the past three decades, both in the UK and in Australia. In 2004 he moved to Geelong, Victoria, and managed Grainsearch, a grower-funded company evaluating European wheat and barley varieties for the high rainfall zone. In 2007, his consultancy managed the commercial contract trials for Southern Farming Systems (SFS). In 2010 he became Chief Executive of SFS, which has five branches covering southern Victoria and Tasmania. In 2012, Jon became a member of the GRDC's HRZ Regional Cropping Solutions Network.

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ROHAN MOTT

A fourth generation grain grower at Turriff in the Victorian Mallee, Rohan has been farming for more than 25 years and is a director of Mott Ag. With significant on-farm storage investment, Mott Ag produces wheat, barley, lupins, field peas, lentils and vetch, including vetch hay. Rohan continually strives to improve productivity and profitability within Mott Ag through broadening his understanding and knowledge of agriculture. Rohan is passionate about agricultural sustainability, has a keen interest in new technology and is always seeking ways to improve on-farm practice.

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RICHARD MURDOCH

Richard along with wife Lee-Anne, son Will and staff, grow wheat, canola, lentils and faba beans on some challenging soil types at Warooka on South Australia's Yorke Peninsula. They also operate a self-replacing Murray Grey cattle herd and Merino sheep flock. Sharing knowledge and strategies with the next generation is important to Richard whose passion for agriculture has extended beyond the farm to include involvement in the Agricultural Bureau of SA, Advisory Board of Agriculture SA, Agribusiness Council of Australia SA, the YP Alkaline Soils Group and grain marketing groups.

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RANDALL WILKSCH

Based at Yeelanna on South Australia's Lower Eyre Peninsula, Randall is a partner in Wilksch Agriculture, a family-owned business growing cereals, pulses, oilseeds and coarse grain for international and domestic markets. Managing highly variable soil types within different rainfall zones, the business has transitioned through direct drill to no-till, and incorporated CTF and VRT. A Nuffield Scholar and founding member of the Lower Eyre Agricultural Development Association (LEADA), Randall's off-farm roles have included working with Kondinin Group's overview committee, the Society of Precision Agriculture in Australia (SPAA) and the Landmark Advisory Council.

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KATE WILSON

Kate is a partner in a large grain producing operation in Victoria's Southern Mallee region. Kate and husband Grant are fourth generation farmers producing wheat, canola, lentils, lupins and field peas. Kate has been an agronomic consultant for more than 20 years, servicing clients throughout the Mallee and northern Wimmera. Having witnessed and implemented much change in farming practices over the past two decades, Kate is passionate about RD&E to bring about positive practice change to growers.

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BRONDWEN MACLEAN

Brondwen MacLean has spent the past 20 years working with the GRDC across a variety of roles and is currently serving as General Manager for the Applied R&D business group. She has primary accountability for managing all aspects of the GRDC's applied RD&E investments and aims to ensure that these investments generate the best possible return for Australian grain growers. Ms MacLean appreciates the issues growers face in their paddocks and businesses. She is committed to finding effective and practical solutions `from the ground-up'.

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2017–2019 SOUTHERN REGIONAL CROPPING SOLUTIONS NETWORK (RCSN)

The RCSN initiative was established to identify priority grains industry issues and desired outcomes and assist the GRDC in the development, delivery and review of targeted RD&E activities, creating enduring profitability for Australian grain growers. The composition and leadership of the RCSNs ensures constraints and opportunities are promptly identified, captured and effectively addressed. The initiative provides a transparent process that will guide the development of targeted investments aimed at delivering the knowledge, tools or technology required by growers now and in the future. Membership of the RCSN network comprises growers, researchers, advisers and agribusiness professionals. The three networks are focused on farming systems within a particular zone – low rainfall, medium rainfall and high rainfall – and comprise 38 RCSN members in total across these zones.

REGIONAL CROPPING SOLUTIONS NETWORK SUPPORT TEAM

SOUTHERN RCSN CO-ORDINATOR: JEN LILLECRAPP

Jen is an experienced extension consultant and partner in a diversified farm business, which includes sheep, cattle, cropping and viticultural enterprises. Based at Struan in South Australia, Jen has a comprehensive knowledge of farming systems and issues affecting the profitability of grains production, especially in the high rainfall zone. In her previous roles as a district agronomist and operations manager, she provided extension services and delivered a range of training programs for local growers. Jen was instrumental in establishing and building the MacKillop Farm Management Group and through validation trials and demonstrations extended the findings to support growers and advisers in adopting best management practices. She has provided facilitation and coordination services for the high and medium rainfall zone RCSNs since the initiative's inception.

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LOW RAINFALL ZONE CO-LEAD: BARRY MUDGE

Barry has been involved in the agricultural sector for more than 30 years. For 12 years he was a rural officer/regional manager in the Commonwealth Development Bank. He then managed a family farming property in the Upper North of SA for 15 years before becoming a consultant with Rural Solutions SA in 2007. He is now a private consultant and continues to run his family property at Port Germein. Barry has expert and applied knowledge and experience in agricultural economics. He believes variability in agriculture provides opportunities as well as challenges and should be harnessed as a driver of profitability within farming systems. Barry was a previous member of the Low Rainfall RCSN and is current chair of the Upper North Farming Systems group.

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LOW RAINFALL ZONE CO-LEAD: JOHN STUCHBERY

John is a highly experienced, business-minded consultant with a track record of converting evidence-based research into practical, profitable solutions for grain growers. Based at Donald in Victoria, John is well regarded as an applied researcher, project reviewer, strategic thinker and experienced facilitator. He is the founder and former owner of JSA Independent (formerly John Stuchbery and Associates) and is a member of the SA and Victorian Independent Consultants group, a former FM500 facilitator, a GRDC Weeds Investment Review Committee member, and technical consultant to BCG-GRDC funded 'Flexible Farming Systems and Water Use Efficiency' projects. He is currently a senior consultant with AGRIvision Consultants.

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HIGH RAINFALL ZONE LEAD: CAM NICHOLSON

Cam is an agricultural consultant and livestock producer on Victoria's Bellarine Peninsula. A consultant for more than 30 years, he has managed several research, development and extension programs for organisations including the GRDC (leading the Grain and Graze Programs), Meat and Livestock Australia and Dairy Australia. Cam specialises in whole-farm analysis and risk management. He is passionate about up-skilling growers and advisers to develop strategies and make better-informed decisions to manage risk – critical to the success of a farm business. Cam is the program manager of the Woady Yaloak Catchment Group and was highly commended in the 2015 Bob Hawke Landcare Awards.

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MEDIUM RAINFALL ZONE LEAD: KATE BURKE

An experienced trainer and facilitator, Kate is highly regarded across the southern region as a consultant, research project manager, public speaker and facilitator. Based at Echuca in Victoria, she is a skilled strategist with natural empathy for rural communities. Having held various roles from research to commercial management during 25 years in the grains sector, Kate is now the managing director of Think Agri Pty Ltd, which combines her expertise in corporate agriculture and family farming. Previously Kate spent 12 years as a cropping consultant with JSA Independent in the Victorian Mallee and Wimmera and three years as a commercial manager at Warakirri Cropping Trust.

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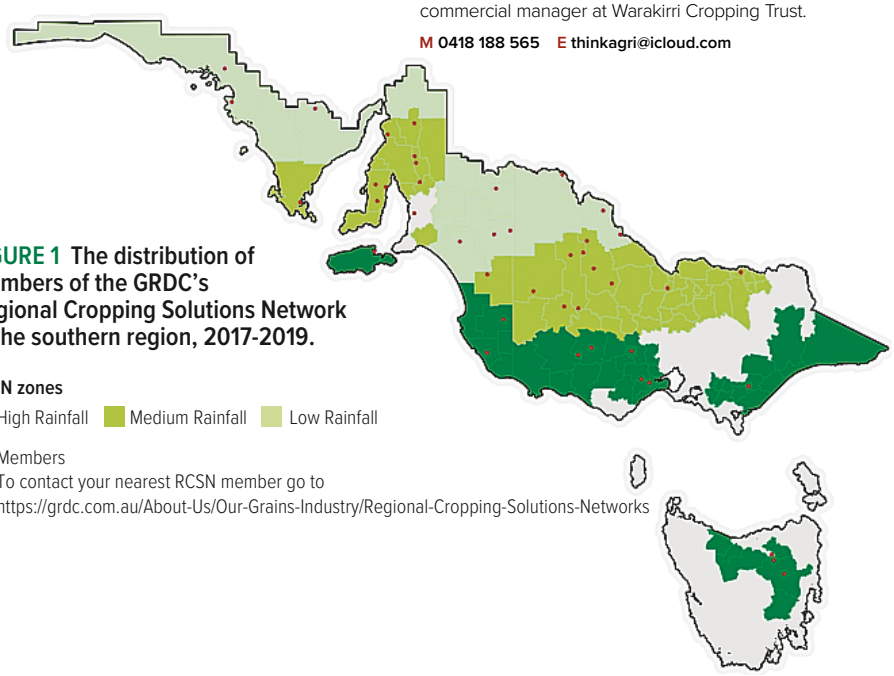

FIGURE 1 The distribution of members of the GRDC's Regional Cropping Solutions Network in the southern region, 2017-2019.

To contact your nearest RCSN member go to https://grdc.com.au/About-Us/Our-Grains-Industry/Regional-Cropping-Solutions-Networks

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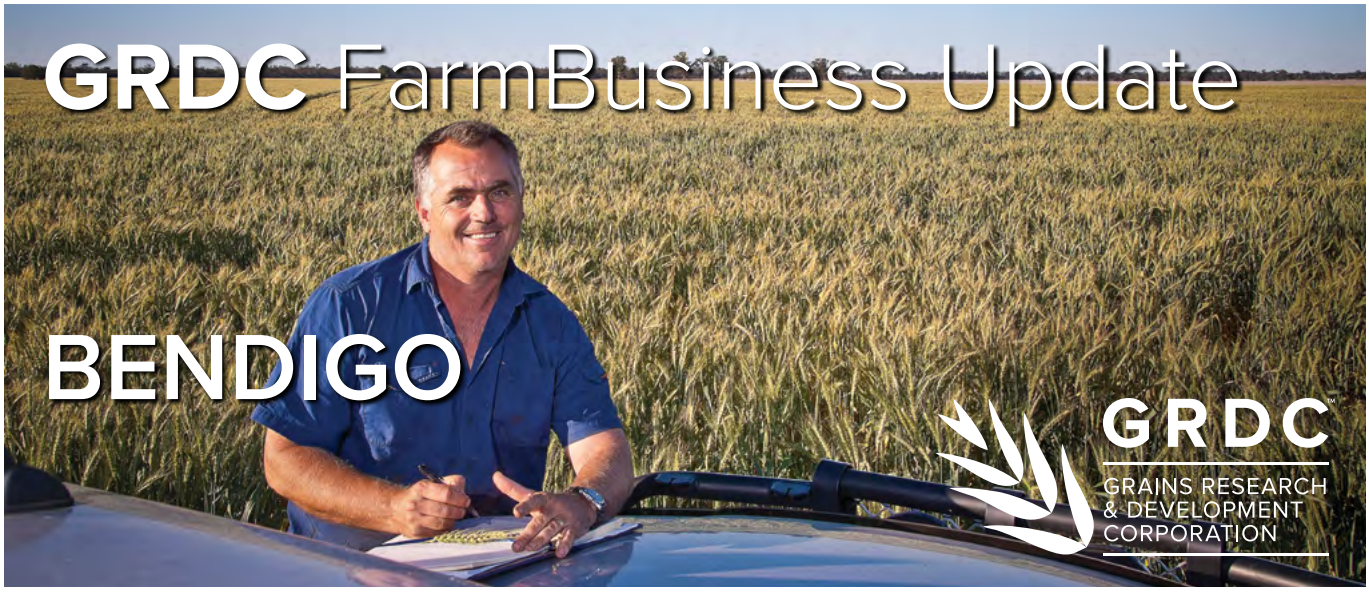

Acknowledgements

The ORM team would like to thank those who have contributed to the successful staging of the Bendigo GRDC Farm Business Updates:

- The local GRDC Farm Business Update steering committee that includes both government and private consultants and GRDC representatives (see page 2 for list of contributors)

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You can now provide feedback electronically ‘as you go’. An electronic evaluation form can be accessed by typing the URL address below into your internet browser.

To make the process as easy as possible, please follow these points:

- Complete the survey on one device (i.e. don’t swap between your iPad and Smartphone devices. Information will be lost).
- One person per device (Once you start the survey, someone else cannot use your device to complete their survey).
- You can start and stop the survey whenever you choose, **just click ‘Next’ to save responses before exiting the survey**. For example, after a session you can complete the relevant questions and then re-access the survey following other sessions.

www.surveymonkey.com/r/Bendigo-FBU

2018 Bendigo GRDC Farm Business Update Evaluation

1. Name

ORM has permisssion to follow me up in regards to post event outcomes.

2. How would you describe your main role? *(choose one only)*

- ❑ Grower
- ❑ Agronomic adviser
- ❑ Farm business adviser
- ❑ Financial adviser
- ❑ Communications/extension
- ❑ Grain marketing
- ❑ Farm input/service provider
- ❑ Banking
- ❑ Accountant
- ❑ Researcher
- ❑ Student
- ❑ Other* (please specify)

Your feedback on the presentations

For each presentation you attended, please rate the content relevance and presentation quality on a scale of 0 to 10 by placing a number in the box (**10 = totally satisfactory, 0 = totally unsatisfactory**).

3. Leveraging your production environment to achieve enduring profitability: *Steve Jefferies*

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

4. How to think about emerging technologies: *Paul Higgins*

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

Concurrent sessions: please circle the session you saw, and review its content relevance and quality

5. 11.20 am	**Planning and measuring sustained profitability, allocating resources more efficiently and reducing operational risk – case study:** *Phil O'Callaghan*	**Solving farm business challenges with technology innovation – developing an idea into a working business solution:** *Naomi Stuart*	**Panel – planning for farm business succession:** *Daniel Cole, Nigel McGuckian and Stuart McKenzie*	**None**

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

6. 12.10 pm	**On-farm storage systems for grain – how on-farm storage can enhance harvest productivity and logistics:** *Peter Botta*	**How data evolution is changing the capabilities for variable rate technology application and outcomes:** *Andrew Whitlock*	**Preparing the next generation for leadership:** *Jill Briggs*	**None**

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

LUNCH

7. 1.55 pm	**Planning and measuring sustained profitability, allocating resources more efficiently and reducing operational risk – case study:** *Phil O'Callaghan*	**Solving farm business challenges with technology innovation – developing an idea into a working business solution:** *Naomi Stuart*	**Preparing the next generation for leadership:** *Jill Briggs*	**None**

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

8. 2.45 pm	**On-farm storage systems for grain – how on-farm storage can enhance harvest productivity and logistics:** *Peter Botta*	**How data evolution is changing the capabilities for variable rate technology application and outcomes:** *Andrew Whitlock*	**Panel – planning for farm business succession:** *Daniel Cole, Nigel McGuckian and Stuart McKenzie*	**None**

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

9. Fatigue prevention – health and wellbeing: *John Toomey*

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

Your next steps

10. Please describe at least one new strategy you will undertake as a result of attending this Update event

11. What are the first steps you will take?
e.g. seek further information from a presenter, consider a new resource, talk to my network, start a trial in my business

Your feedback on the Update

12. This Update has increased my awareness and knowledge of farm business decision-making

Strongly agree	Agree	Neither agree nor Disagree	Disagree	Strongly disagree
❑	❑	❑	❑	❑

13. Overall, how did the Update event meet your expectations?

Very much exceeded	Exceeded	Met	Partially met	Did not meet
❑	❑	❑	❑	❑

Comments

14. Do you have any comments or suggestions to improve the GRDC Update events?

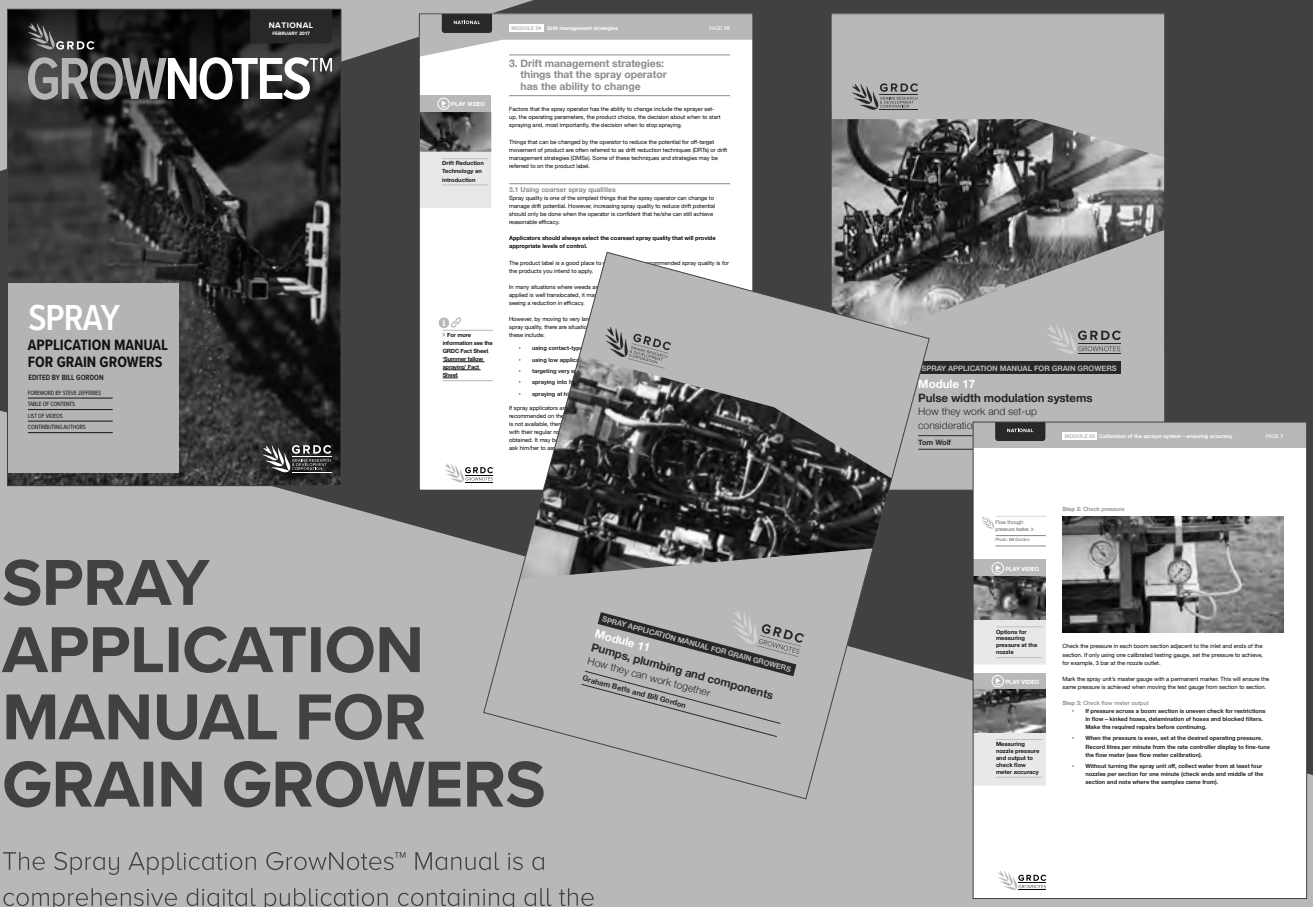
15. Are there any subjects you would like covered in the next Update?

Thank you for your feedback.

GRDC™ GROWNOTES

NEWNEWNEW

SPRAY APPLICATION GROWNOTES™ MANUAL



SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

The Spray Application GrowNotes™ Manual is a comprehensive digital publication containing all the information a spray operator needs to know when it comes to using spray application technology.

It explains how various spraying systems and components work, along with those factors that the operator should consider to ensure the sprayer is operating to its full potential.

This new manual focuses on issues that will assist in maintaining the accuracy of the sprayer output while improving the efficiency and safety of spraying operations. It contains many useful tips for growers and spray operators and includes practical information – backed by science – on sprayer set-up, including self-propelled sprayers, new tools for determining sprayer outputs, advice for assessing spray coverage in the field, improving droplet capture by the target, drift-reducing equipment and techniques, the effects of adjuvant and nozzle type on drift potential, and surface temperature inversion research.

It comprises 23 modules accompanied by a series of videos which deliver 'how-to' advice to growers and spray operators in a visual easy-to-digest manner. Lead author and editor is Bill Gordon and other contributors include key industry players from Australia and overseas.

Spray Application GrowNotes™ Manual – go to: https://grdc.com.au/Resources/GrowNotes-technical Also go to https://grdc.com.au/Resources/GrowNotes and check out the latest versions of the Regional Agronomy Crop GrowNotes™ titles.

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