GRDC INVESTMENTS ADDRESSING A SELECTION OF ISSUES – HIGH RAINFALL ZONE RCSN – June 2018

ISSUE	PAGE NO.
Issue No. 17 - Extracting greater 'value' from spatially referenced data which is already being collected.	1
Issue No. 19 - Improved grain marketing through expanded or differentiated markets (faba beans and cereals) and greater grower marketing skills advice to get a better price.	2
Issue No. 19 - Determine how optical sensors can be used profitably to inform decision making.	3
Issue No. 24 - Identify the reasons for inconsistent nodulation (and subsequent yield loss) in faba and broad beans.	4
Issue No. 24 - Determine if cover crops have a profitable impact on soil health.	6
Issue No. 29 - Determine sustainable and profitable management strategies of high volume stubbles.	8
Issue No. 30 - Develop a faba bean and broad bean agronomy package.	9

Issue No. 17 - Extracting greater 'value' from spatially referenced data *which is already being collected*.

An enormous amount of data is being captured by growers and their contractors, either consciously (drones, soil testing, EM) or because technology now enables this to happen (yield monitors, satellites). This data includes soil pH, elevation, Normalized Difference Vegetation Index (NVDI), yield and grain quality. Most of the data collected is geo-referenced, potentially enabling different interventions in different parts of a paddock.

Extracting 'value' from this data is in its infancy, but on the surface appears to have great potential to improve profitability. For example collected information could be used to assess the impact of diseases and nutrition or provide the opportunity to measure and quantify the financial value of treatments, thus enabling greater value from on-farm trials to be obtained. Typically the data collection is driven by those at the technology end (sensors and data capture) rather than the end user (data user and decision maker). There is a need to understand what data would be valuable to inform the decision maker and then examine what data *that is already being collected* could meet these needs.

<u>GRDC investments addressing this issue –</u>

Data-driven agriculture is a core framework underpinning RD&E investment within GRDC's new 5-year RD&E plan. Precision agriculture technology and analytics will enable grain growers to gain an improved understanding of the yield, cost and risk components of their production systems. GRDC is building its digital agriculture portfolio and is a unique position to invest in the science that is necessary to enable growers to realise greater value from the data that is already being captured.	
Assessing the economic value of precision agricultural tools for grain farming businesses in the Southern region	The aim of this investment is to provide growers and advisers in the southern region with enhanced capacity and skills to assess the economic impact of the adoption of various precision agriculture (PA) technologies in order to make informed business decisions. This will be achieved by identifying key technologies and situations where PA has been proven to consistently improve the profitability of cropping systems; developing a simple decision matrix and related tools to support PA decision making; producing relevant high impact communications and extension activities to promote awareness and build the skills, knowledge and confidence to motivate growers and advisers to realise the profitability opportunities presented by the broader adoption of PA in the GRDC Southern region.
Program for improving farmer confidence in targeted N management through automated sensing, decisions and	In a joint collaboration with the CRDC, the GRDC have been focusing on the challenges of increasing grain and cotton industry profitability and safety by optimising the use of inputs, enabling new farming practices and the automation of routine processes. As part of the analysis, both industries have identified that further improvement in N use efficiency is required to optimise within-field yield and quality management.

intelligent infrastructure – Future Farm Initiative (Phase 1)	Phase one has reviewed the current status and recommended: • which technology to focus on in Phase 2 of the Future Farm initiative • methodologies and software tool/s for research and development to support the increased automation of N application decisions • potential commercial providers who might be approached for potential participation in the remainder of the project as its commercial partner/s • expected benefits to growers and industry of the technology selected, and a path to impact for delivery • Detailed project work plan for Phase 2 appropriate to the technology(/ies) and methodologies selected • Resources and expertise required to deliver against this Phase 2 work plan, and a project proposal as required.
Future Farm - Phase 2: Improving farmer confidence in targeted N management through automated sensing and decision support	This project will aim to develop an automated analytical framework to help growers realise the greatest value they can from all the different streams of input data that relate to nitrogen decision making, all via a seamless, easy-to-use interface. When leveraging available, GPS-referenced grower-data against publicly available data-sets such as the Soil and Landscape Grid of Australia, new mid-long range seasonal forecast tools developed by the Bureau of Meteorology, multi-spectral imagery from Landsat, Sentinel and MODIS satellites, the NASA Soil Moisture active passive mission and other data sources, growers will be equipped with a sophisticated technology that leverages, and builds upon, available grower data to help growers make more profitable N decisions.
Understanding plant available soil water and implications for crop management (RPI00009)	Variation in plant available water (PAW) is a major determinant of in-paddock variability in crop growth and yield. This project is aiming to determine if existing datasets (e.g. EM, NDVI, yield maps) be processed to create maps that reflect variability in PAW as measured using spatial soil sampling and moisture probes, to accurately map yield potential and N response across a paddock, thus managing variability and maximising profitability across the paddock. Objectives of the project are: • Understand how PAW varies across four paddocks, based on spatial sampling and soil moisture probes, and determine if current precision ag datasets can correlate with PAW. • Determine the value of variable rate N applications, based on zones within paddocks. • Demonstrate the use of NDVI to inform variable rate applications of N. • Connect spatially distributed soil moisture with N supply.
Spatial variability of soil acidity and response to liming in cropped land of the Victorian HRZ (DAV00152)	The project in the HRZ of Victoria aims to: 1. Deliver new surface and subsurface pH maps linked to acidification processes and rates for the Victorian HRZ. 2. Understand yield response to application of lime for variable pH soils in the HRZ. 3. Determine the net economic benefits and risks of liming spatially variable pH soils at paddock and farm scales.
DEDJTR Regional Agronomist DAV00143	The DEDJTR Bilateral Agronomists spend 6 months between DEDJTR, A Farming systems group and a commercial enterprise. Alexander Clancy 2018 graduate agronomist will be focusing on Precision Agriculture working with Agriculture Victoria's remote sensing specialists at Bendigo and agri-business, Precision Agriculture for 12 months of his placement – at time of writing his farming system group placement was not confirmed.

Issue No. 19 - Improved grain marketing through expanded or differentiated markets (faba beans and cereals) and greater grower marketing skills advice to get a better price.

Farm profit is influenced by the price received for a commodity. There is a belief that profit could be improved if (i) there was greater differentiation in markets, especially with cereals and faba beans and (ii) growers had improved grain selling skills (either themselves or in partnership with a grain marketer).

Differentiated markets may also encourage growers to introduce some more novel crops in the rotation, thereby helping manage disease, pest and nutrition, i.e. having markets and favourable prices influences rotation choices.

<u>GRDC investments addressing this issue –</u>

GRDC Farm Business Updates – Southern Region (ORM 1505-002SAX)	GRDC Farm Business Updates continue to have a grain marketing segment in the program. Format is being trailed to include greater participant interaction.
Market Intelligence for Theme 1 (AEG00006)	Market opportunities and requirements for Australian grains. Investment works with international markets on the quality parameters required for end users in cereals, oilseeds and pulses.
DEDJTR Pulse Breeding (DAV00143)	Key aspects proposed are the need for a classification system that takes into account quality parameters for which the market is prepared to pay, and thereby provide improved returns to growers, there is an objective imaging system being developed in DAV00153 that would contribute to impartial classification for such characteristics.
Rural Business Support (9176026)	Building grower capacity and knowledge in the development of farm business management strategy Farm Business Strategic review. This investment looks create greater understanding with the farm business of the financial performance of the business and to identify areas of improvements and the resourcing of farm business management decision making.

Issue No. 19 - Determine how optical sensors can be used profitably to inform decision making.

Optical sensors, which use specific wavelengths to collect a range of reflectance data measurements, are becoming cheaper and more common. While they can be shown to collect and differentiate images, the value of the data to inform decision making is unclear. There are suggestions it could be used to inform summer weed control, crop establishment and damage, variable rate nitrogen, validate areas of waterlogging and where drainage is required, crop disease prevalence and crop maturity to determine timing of desiccation or windrowing. None of these suggestions have been well developed.

On the surface there appears to be lots of opportunities to use sensor data, but just what this is and importantly how it can be used to improve decisions and profit is unclear. The people promoting the technology are enthusiastic, grower and advisors are curious but the application (and proof it is profitable) is yet to be established.

The risk of leaving it to the market is (i) the sensor technologists will assume what growers need – and may not get this right and/or (ii) individuals pursue the potential but then do not share with the wider industry (market failure). This is costly to the individual and the wider grains industry.

<u>GRDC investments addressing this issue –</u>

GRDC have (and have had) a number of projects examining optical sensing for a range of end-use applications. In general, often times an application will work well in a laboratory in a controlled environment, but when taken to the field and exposed to an array of environmental variables the reliability of a 'spectral signature' is poor. Even if a sensing methodology works well technically, the cost of embedding that into an existing process may be too prohibitive when weighed against the respective benefit. Below is just a few of the most relevant investments.

Future Farm Theme 1: Intelligent Sensing (CSP00201)	This investment delivered a comprehensive technical review identifying limitations and opportunities with different proximal and remote sensing methods for crop nitrogen applications. It also provided insights regarding methods for radiometric calibrations, the pros and cons of different optical crop sensing equipment used around the world, and recommendations for future R&D to develop methods that could enable growers to extract more profit from proximal sensing than they do currently.

Spatial temperature measurement and mapping tools to assist growers, advisors and extension specialists manage frost risk (CSP00198)	Part of this investment is assessing the capability of a range of sensing methods (multispectral imaging, fluorescence, thermal infra-red) to detect frost damage via remote sensing platforms. This investment will deliver a comprehensive technical report in February 2019 for growers, advisors and agronomists to help demystify some of the claims around optical sensing for frost damage, and shed light on important considerations for setting up and using proximal sensing equipment more broadly.
Hyperspectral data for estimating leaf biochemistry (GRS 9165910)	PhD student is working to explore the capabilities of hyperspectral imaging as a non-destructive method, and developing calibration models for estimating nutrient distribution in leaves. This is part of a broader effort to build capacity in the technical basis of proximal and remote sensing.
Direct comparison between selected field infrared instruments for the prediction of soil properties in grain cropping soils (CSO00045)	Many growers in Australia now have a good understanding of the variability of crop yield across a paddock or the landscape (gained from yield monitors on headers) but few have access to spatially dense information on soil properties, due largely to the labour and costs involved in sampling and physico-chemical analysis of soils in analytical laboratories. This project examined the potential of using portable and miniature infrared spectrometers to analyse soils in the field. Cheaper miniature instruments showed limited success for measuring soil properties due to their limited spectral range. However, larger but still portable (hand-held) spectrometers performed very well (as good as laboratory spectrometers) opening up the possibility of analyzing soils *in situ* in the field. Under field conditions, the portable instruments performed very well for determining a wide range of soil properties (organic carbon, phosphorus buffering index, exchangeable Mg & Na, CEC, Ca:Mg ratio, clay, sand and silt content), opening up the possibility of much better assessment of soil variability in paddocks (to relate to yield maps) and to improve the precision of soil management.
Assessment of N and water co-limitations by remote sensing as a tool to improve wheat and canola profitability and manage risk (DAS00165-BA)	The current work analysed a set of modern and old wheat cultivars in terms of water and N co-limitation in a low rainfall location of Eyre Peninsula. The current study aimed to validate the 2017 season's co-limitation results, and test the remote sensing prediction of water and nitrogen RS (remote sensing, spectroradiometry) status of the crop in different locations of the Eyre Peninsula. Nitrogen and water measurements of RS and traditional methods were highly correlated across trials. RS was not capable of detecting differences between treatments and variety in a consistent way across trials. One reason may be associated with the timing of treatments and sampling during the growing season. RS technology has great potential for estimating water and nitrogen content in wheat instead of applying traditional methods, however, further studies need to address environment confounding effects and timing.

Issue No. 24 - Identify the reasons for inconsistent nodulation (and subsequent yield loss) in faba and broad beans.

It is widely recognised that the nodulation of faba and broad beans in the HRZ is poor and unreliable. This has major implications for growers relying on these pulses, both in direct yield but also the nitrogen fixation achieved.

Identifying the causes of inconsistent nodulation is the first step to developing effective strategies to improve both the level and consistency of nodulation to improve nitrogen fixation and yields. This is unlikely to be a simple task because product, handling regimes, chemical and rotation history, soil types and the wider farming system are all likely to be contributing factors.

<u>GRDC investments addressing this issue –</u>

Increasing the effectiveness of nitrogen fixation in pulse crops through improved grower and advisor awareness and knowledge of	This three year communication and extension focused investment aims to extend research outcomes in a practical and applied manner, utilising a range of approaches to realise on-farm impact of related investments in R&D, subsequently improving crop nodulation, N fixation and grain legume yields across the GRDC southern region. The investment will increase awareness and build knowledge of growers and advisors concerning commercial inoculant types, formulations and inoculation techniques, and develop their skills regarding the monitoring and assessment of legume nodulation, and mitigation of any possible impacts of crop protection products and fertiliser treatments on

inoculation and crop management practices in the Southern region (to be contracted)	rhizobia survival and effectiveness. This investment will link closely with other GRDC R&D, validation, extension and communication investments, in support of the sustainable expansion of pulse production across all rainfall zones, thereby enhancing farm profitability and system diversity across the GRDC southern region. This includes extension and communication of the outcomes and findings from a related research, development and validation project that aims to develop and release improved rhizobia strains, and identify enhanced inoculation and crop management practices to maximise N fixation. The successful applicant will work with growers and key influencers to promote best management inoculation and pulse management practices to drive the required practice changes. By June 2021, Southern region winter pulse crop growers and their advisers will have a high degree of awareness and appropriate knowledge and skills to implement management practices to ensure effective nodulation and improved nitrogen fixation. Growers and advisors will be proficient in assessment and monitoring of nodulation on key pulse crops; have an understanding of commercial inoculant types, formulations and inoculation techniques; and be able to proactively mitigate any possible impact of crop protection products and fertiliser treatments on rhizobia survival and effectiveness. Coupled with other GRDC investments in pulse crop R&D, validation, extension and communication, this project will support the sustainable expansion of pulse production across all rainfall zones, thereby enhancing farm profitability and systems diversity across the southern region.
Increasing the effectiveness of nitrogen fixation in pulse crops through development of improved rhizobial strains, inoculation and crop management practices	This GRDC investment aims to enhance nitrogen (N) fixation of winter pulse crops through improved rhizobial strains for hostile soils and enhanced inoculation practices that minimise the potential impact of fertiliser and crop protection applications, and maximise rhizobial survival, nodulation and nodule function. These improvements will broaden the adaptation of pulses onto soil types and areas where they are currently not widely cultivated. This R&D investment will be supported by an extension and communication investment to promote awareness of nodulation and N fixation in pulses, and adoption of best inoculation practices. The expected outcome of this investment is that by June 2022, growers in the southern region have access to improved rhizobial strains compared to the current commercial inoculums for winter pulse crops, plus best management practices for optimising nodulation and nitrogen (N) fixation, including minimising the impact of fertiliser and crop protection applications. These innovations will enhance N fixation and production of pulse crops with flow on benefits to following crops, and enable expansion of pulses onto soil types and in agro-ecological zones where they are currently not widely grown.
Nitrogen fixing break crops and pastures for HRZ acid soils (DAN00191)	There is a lack of profitable nitrogen fixing break-crop options for low pH soils in the southern high rainfall zone (HRZ). There is a pressing need for a profitable legume rotation option. This project will address three key problems cited by GRDC: 1. the need to reduce reliance on fertiliser nitrogen; 2. managing herbicide resistance; 3. improving integration of livestock into cropping systems. Activities include: a. A project reference committee to consider the results from a review of past and current research of N fixing break-crops in the HRZ acid soil zones, and feedback from grower focus meetings and an on-line survey. This process will – i. assist in identifying factors limiting implementation of effective crop sequence management in the HRZ; ii. identify research priorities; iii. guide the extension and evaluation plan. b. An assessment of the yield potential and N-fixing effectiveness of pulse crops in regional NVT (National Variety Testing) trials in the HRZ will assist in identifying the degree to which plant breeders are contributing to solving the agronomic limitations identified. c. A survey of paddocks of collaborating farmers concurrently with the aim of obtaining hard data to

	assist explanation of the farmers' N-fixing crop experiences. These paddock surveys will aim to identify potential biotic and abiotic handbrakes to N fixing break-crop growth and also collect seed of weeds believed to be resistant to herbicide. Soils on the survey farms will be characterised to identify chemical and physical plant growth handbrakes. d. Information collected from the survey farms will inform subsequent experimentation and assist in the location of appropriate sites and collaborators for the on-farm trials that will occurred in Years 2, 3 and 4. It is anticipated that these trials will include two pulses and two forage legume species. Commencing in 2015, two staggered crop sequence trials, each lasting two years, will be established at two trial sites, one located in VIC and the other in NSW. e. Soil collected from collaborating farms will be used in glasshouse pot studies to identify locally relevant problems. The glasshouse studies will focus on factors that are difficult to assess in the field, e.g. the impact of different soil pH level on the residual activity of sulfonylurea herbicide and associated effect on root pruning and N fixation. Results from such trials will be important for the management of any herbicide resistant weeds. This study provides ideal opportunities for upskilling next generation researchers by training a PhD student if one is available. The project aims to have 150 farmers across these zones implementing a crop sequence management system incorporating N fixing break crops using clearly defined processes and agronomic guidelines that will allow managers to evaluate crop sequence performance.
Agribusiness Trials and Extension investment – AgKI	Three field trials on Kangaroo Island in 2015 to assess a range of potential tactics to improve the nodulation of broad beans which included the following treatments – 1. Standard commercial rhizobial strain WSM1455 applied in peat (double rate) 2. Acid-tolerant rhizobia SRDI954 in peat (double rate) 3. Acid-tolerant rhizobia VetchW181 in peat (double rate) 4. Tag Team rhizobia WSM1455 plus Pencillium 2.5 kg/ha 5. MAP fertiliser 80 kg/ha (compared to DAP used for all other treatments) 6. No molybdenum (Mo was added in furrow at 125 g/ha for all other treatments) 7. Pulse Aider 80 L/ha of 1:1 diluted product 8. Calciprill 500 kg/ha 9. Calsap 10L/ha, diluted 1:10 for use 10. Urea 200 kg/ha plus 100 kg/ha top dressing in September (no rhizobia) 11. Lime pelleting peat preparation (treatment 1) on to seed, using garden lime 12. Nil rhizobia and nil urea.

Issue No. 24 - Determine if cover crops have a profitable impact on soil health.

Cover cropping is a relatively new practice that is being tested in some cropping systems. A cover crop is defined as a three to nine month crop that is grown primarily for biomass, i.e. not grain but may or may not be grazed. It could be a monoculture or include multiple species, including nitrogen fixing species. It is not necessarily a summer crop.
The primary objective of introducing a cover crop is to enhance 'soil health'. It is assumed improved soil health will lead to greater resilience and greater profit.

The enhancement in soil health are thought to be derived from increased carbon sequestration, having longer periods of active material for soil biota to feed on, moderating soil temperature, enhancing soil structure and building soil nitrogen. In some locations and farming systems, the cover crop is also seen as a way of controlling summer weeds, extracting soil moisture (to reduce subsequent waterlogging periods) and utilising excess water by growing more annual biomass.

In theory the benefits of cover cropping are attractive and the proposition 'make sense' at a general level. However there is very little information to understand what changes cover cropping is having to 'soil health' (and then ultimately to the flow on effects to other parts of the business, impact on financial performance and risk in the farming business).

<u>GRDC investments addressing this issue –</u>

Cover crops for No-till farming systems in the Western Region (WAN00013)	The introduction of cover crops into no-till farming systems can provide increased soil cover, add diversity to the system and smother weeds. The primary function of cover crops is to produce biomass thereby providing continuous ground cover that protects the soil from erosion, conserves moisture, suppresses weeds, adds diversity, promotes soil biological activity and increases soil fertility through nutrient cycling. Other benefits include reducing compaction and fixing atmospheric nitrogen. For cover crops to be introduced into Australian farming systems they must have cheap seed, minimal inputs and minimal interference with the main cropping program and be easy to manage. A number of cover crops were identified as providing these benefits in WA and by combining in mixtures it can increase the benefit to one system. Saia oats provide tall growth, high biomass, early vigour and are competitive with weeds but may be more suited to higher rainfall areas and maybe not suited to alkaline soils. They also require more fertiliser and a longer growing season to reach maximum biomass and the correct stage for knife rolling compared to some other cover crops. Mixtures of oats and vetch have offered great potential as a cover crop providing good biomass, some nitrogen fixation and early maturity with minimal inputs. Mustards have shown good potential in producing high biomass and are more suited to drier areas due to their drought tolerance. They also provide a good break crop and the tap roots can help to loosen the soil. Pasture legumes can provide good biomass, a break crop, nitrogen fixation and by dry sowing with ALOSCA granules it offers advantages in timeliness and increased biomass production potential. Under-sowing French serradella has shown great potential in reducing establishment costs and producing a legume cover crop which will fix nitrogen and benefit the following cash crop.
Cover crop and stubble management systems for the central and southern NSW (CWC00003)	This project was established to investigate the potential to grow and maintain groundcover in a continuous cropping system environment in southern and central NSW through the use of cover crops. A site was established at Wellington NSW and a range of summer growing options were used following winter wheat crops to determine the resultant impact on soil water storage, nutrient availability and cycling, weed populations, biomass production and subsequent wheat yields. Results suggest that further work looking at a greater range of options of cover crop and pastures are required. This research tested the arguments promoted for cover cropping and identified how they might be implemented in a farming system. The critical need to improve soil fertility generally within farming systems means there is a case for investigating legume cover crops over summer followed by good legume pasture phases such that the decline in soil fertility is averted. A decline in the soil N status occurred in all the cropping tactics tested. However, incorporating legume cover crops and pastures could allow more frequent opportunities for grain crops than with traditional practices. A legume cover crop grown for 3 years and then followed by a 2 year pasture phase could restore soil fertility and allow for 18 wheat crops over 30 years compared to traditional fallows that after 3 years you may need 4 years of pasture to restore fertility so that over 30 years you only get 13.5 wheat crops. Taking a conservative approach and assuming the same average wheat yields after fallow and cowpeas apply with this strategy (3.5t /ha), the average grain produced over 30 years would be 47.3t /ha after fallow and 63t/ ha following cowpeas.
Quantifying the effectiveness of cover crops as a means of increased water infiltration and reduced evaporation in the northern region (DA00211)	Recent research suggests that cover crops and increased stubble loads can reduce evaporation, increase infiltration and provide net gains in Plant Available Water (PAW) over the traditional fallow periods. More effective capture and storage of rainfall for crop use remains as a major challenge for both grain and cotton growers across the northern region where only 20-40% of rainfall is typically transpired by dryland crops, while up to 60% of rainfall is lost to evaporation, and a further 5-20% lost in runoff and deep drainage. Consequently cover crops will increase the profitability of our current systems if they can reduce evaporation and increase the available water for subsequent crops. Five trials have been established: Two with initial winter cover crops, and a further three with summer cover crop. Water use by the different cover crops has varied, with subsequent recharge improved on some treatments to even out available water to the 'cash' crop at planting. Final crop impacts (yield) are yet to be measured. Grower interest in biological impacts remains high and the project will monitor some key indicators on selected treatments at sites with the longer fallows.

Issue No. 29 - Determine sustainable and profitable management strategies of high volume stubbles.

The quest for higher yields has an undesirable legacy – heavy stubble loads. These heavy stubbles create real challenges, in the establishment of subsequent crops, disease and pest carry over herbicide efficacy.

The grains industry has been active in trying to find approaches that minimise the negative impacts of high stubble loads, while trying to retain the benefits of retained stubble (groundcover, extra carbon and nutrients). Row spacings, inter-row sowing, no grazing, harvest height, bailing, machinery modification, incorporation are some of the tactics being employed. Burning is another tactic that, although practiced less often that decades ago, is still used because it 'solves many problems' easily and quickly (removes the stubble, kills disease, pest harbour, reduce weed seeds etc.).

The challenge is to enable growers and advisors to put together a number of tactics into a strategy that is, on balance, are appropriate for the time and the situation. The package of tactics is likely to change from region to region, year to year and even between paddocks with the same year. There is no recipe.

<u>GRDC investments addressing this issue –</u>

GRDC Stubble Initiative - Maintaining Profitable Farming Systems with Retained Stubble in Victoria & Tasmania Upper Eyre Peninsula Lower Eyre Peninsula South East & Kangaroo Island Yorke Peninsula & Mid North Upper North Riverine Plains Mallee	The ultimate goal of the GRDC Stubble Initiative is to provide southern growers with practical information to guide their crop management, underpinned by results from local trials across the region. The initiative involves farming systems groups in Victoria, South Australia, southern and central New South Wales and Tasmania collaborating with research organisations and agribusiness to explore and address issues for growers that impact the profitability of cropping systems with stubble, including pests, diseases, weeds, nutrition and the physical aspects of sowing and establishing crops in heavy residues. The initiative aims to address the issues with stubble retention, quantify the effects that these issues are having on yield and profitability, develop practical solutions and then extend the knowledge to grain growers and their advisers.
GRDC Stubble Initiative — Maintaining profitable farming systems with retained stubble in the South East and KI regions **(**MFM00006)	In the South-East region, the biggest inhibitor to retention of stubbles is pest control (and in particular snails). This problem once isolated to the more alkaline coastal regions, is now a widespread issue across the region. Ways to try and manage the stubbles in a way that will provide adequate snail control with stubble retention over a medium- long-term (3 - 5 year) period will be the biggest challenge in stubble retention systems. Livestock (hoof activity) may have a role to play in the management of snails; due to the nature of the farming systems, this may also be investigated. These activities will be carried out at 2 main focus sites across the South-East region at Conmurra (650mm rainfall; black calcareous clay/loam soil located near Lucindale) and Frances (525mm duplex soil), where replicated sub-treatments will be overlaid on different stubble management treatments. The areas will be EM38 surveyed to try and reduce the soil variability of the site, as the stubble treatments will be carried out using farmer equipment (and not plot equipment). The pests will only be investigated in the site at Conmurra where an exclusion zone will be created around an area specifically set up to look at snail control. This will be done so that the remainder of the site can be 'protected' from damage, and other outcomes can be successfully achieved. AgKI will focus on those issues that are specific to the Kl region; demonstration and extension work around snail and slug management with retained stubbles, the effects of stubble loads on canola establishment, nutrition issues with retained stubble management, and the long-term disease issues with different stubble retention methods in a wheat/canola rotation (a common rotation on the Island).

GRDC Stubble Initiative — SFS component of the BCG contract (BWD00024)	Numerous research focus areas for stubble interactions within farming systems however key ones focussed on large stubble loads in the SFS HRZ area are: 1. Stubble type produced at harvest 2. Harvest machinery set up and operation 3. Managing stubbles post-harvest 4. Seeding canola into heavy stubbles 5. Pro-active approach to seeds in retained stubbles 6. Pre-emergent herbicides in retained stubbles 7. Pest management 8. Crop Nutrition
GRDC Stubble Initiative —Research component – CSIRO *et al* (CSP00186)	CSIRO led the research component with the extension of these findings transmitted through the 10 farming systems groups Key areas CSIRO focussed on were: 1. Nutrition (namely N) 2. Weeds 3. Insects / Pests – Approx. 5% Nutrition developed research findings for mineralised N amounts per tonne DM of stubble, N tie ups, when N would be mineralised, elements to change rate of decomposition (i.e. standing vs laying vs incorporated stubbles). Also N15 work to determine the rate of N breakdown and where it moves to (i.e. grain or soil) over subsequent years/seasons.

Issue No. 30 - Develop a faba bean and broad bean agronomy package.

The HRZ desperately needs a pulse in the cropping rotation. Gowers and advisors currently dabbling with pulses are finding them often unreliable and not profitable. Yet they believe there is opportunity with pulses, especially with the test yields being reported of newer varieties. Part of their optimism stems from a feeling they are under prepared (need more knowledge, skills, confidence) to apply the right agronomy to realise the potential of the varieties available. i.e. it's not the plant that's the limitation or a desire to use it, rather it's how we manage it that's the limitation.

<u>GRDC investments addressing this issue –</u>

GRDC Faba bean Southern Region - GrowNotes™	https://grdc.com.au/resources-and-publications/grownotes/crop-agronomy/faba-bean-southern-region-grownotes
Understanding the implications of new traits on adaptation, crop physiology and management of pulses in the southern region (DAV00151)	1. New traits for modern farming systems - Strategic genotype x management research will be conducted that provides information on understanding and maximising the benefits of new traits/genes recognised in the breeding program through improved crop management - a. Herbicide tolerance and weed ecology - Understanding the agronomic importance and viability of traits linked with weed management and herbicide tolerance in lentil and faba bean (metribuzin and Group B tolerance) and chickpea (potentially Group B and Group I). Implications for weed management and ecology will also be considered, including early maturing varieties for crop topping. b. Disease management – In field pea, blackspot continues to be a major limitation to production. Recent work in SA by the SPA and in France by INRA suggest there are opportunities to minimise the risk of blackspot by combining novel fungicide applications, with improvements in genetic resistance enhanced by plant morphological and architectural differences. In faba bean and chickpea, resistance to ascochyta blight has recently broken down and implications for management packages need to be elucidated. c. Canopy management (biomass and architecture) – In lentils and faba beans improvements in vigour, architecture and biomass development combined with improved disease resistance, may require reduction in seeding rates, particularly when combined with early sowing dates

	to secure yields in dry years. There are also opportunities to better manage bulky canopies and maximise pod set through a combination of crop management and genetic practices including the use of PGR's. d. Harvest quality – Little is understood about the impact of adverse weather events on mature crops, yet major quality and industry issues have arisen when they have occurred in the past. Genetic and agronomic differences have been reported as being important in reducing quality losses. Opportunistic research through trials assessing delayed harvest and weather events on a range of genotypes under the same conditions will add to this knowledge both for producers and breeders. 2. Variety specific agronomy packages (VSAP) - Targeted agronomic research will produce data for new pulse varieties which will be synthesised into management packages for the southern Australian cropping regions in collaboration with PBA or other pulse breeding organisations. This will deliver maximum benefits of new varieties to growers immediately after they are released. The pulse industry views the delivery of VSAP's and the matching of genotypes to optimum farming systems as an essential link in the development of new varieties by PBA.
Building capacity, skills and knowledge for the pulse industry in the Southern Region: Supporting expansion of high value pulses into new areas and ensuring sustained profitability of all key pulse crops in existing areas.	Pulse crops have long been recognised as providing numerous economic and farming system benefits including: biological nitrogen fixation; providing a disease break for some foliar and soil-borne pathogens; enabling increased diversity in weed management; and providing agronomic and economic diversity in enterprise mix. Whilst immediate opportunities for expansion in pulse area in the Southern Region may be apparent, and are in-fact occurring, the willingness of growers to adopt is often limited due to a range of factors including: perception of risk and complexity in production; concerns over the longer-term sustainability of pricing as Australian production increases; lack of local agronomic knowledge and support; agronomic challenges relating to disease, weed and pest management; seed-cleaning, storage and marketing issues; and required investments in plant and infrastructure. Pulses are considered by many to be complex to manage and poor agronomy subsequently poses a risk to the profitability of inexperienced growers. The present shortage of specialised knowledge and skills relating to pulse crop agronomy within industry necessitates targeted investment in capacity building within the advisory sector to build future industry leaders and provide agronomic support to growers through the multiplier effect. In building this capacity special consideration needs to be given to the demand on existing recognised experts within the pulse industry, specifically key personnel within the research community. In addition, a targeted program to directly build the skills, knowledge and confidence of growers in the production of high value pulse crops, focusing upon lentil and chickpea, is required to hasten the successful expansion in area planted to these crops in the Southern Region. It is proposed that a participatory approach to knowledge transfer is implemented, targeted to identified geographical areas for expansion where these crops may be well adapted. This investment involves delivery of discussion groups, training, workshops and communication materials to realise long-term farming system and financial benefits to build capacity, skills and knowledge for the pulse industry in the Southern Region.
Improving the profitability of pulse production through local validation of research outcomes in the Southern Region	A targeted validation trial program of significant scale to deliver local data and knowledge for the development of pulse crops suitable to areas across the southern region where research and development is limited. In collaboration with the Southern Pulse Agronomy project (DAV00150), pulse crops and constraints need to be prioritised for each agro-ecological zone to develop the focus of the validation program. For example, it is envisaged that up to four of the most important pulse crops and up to four constraints will be examined in each zone where gaps exist. Local biophysical data from the validation trials and their impact on crop management, farming systems and farm economics will be made publicly available. The validation trial data will feed back into research and development activities of the Southern Pulse Agronomy project, and new knowledge will flow into the pulse extension project. In partnership with these and other GRDC projects, this investment, commencing in 2018, will deliver greater knowledge of the pulse phenotypes suited to each agro-ecological zone and management practices to optimise their production and profitability.