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

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Issue No. 1 – Developing new food-based markets for pulses to help growers manage price volatility.

Pulse commodity price is highly influenced by demand in the Middle East (e.g. faba beans) and the Sub-continent (e.g. lentils). Developing new markets through novel food uses for pulses or gaining market through greater market access of trade agreements may reduce price volatility of pulses.

GRDC investments addressing this issue –

GRDC Economics has looked into is the use of pulse protein in wheat based products, e.g. as a durum substitute for pasta. Independent work by the Functional Grains Centre at Charles Sturt University with San Remo has resulted in the pulse pasta products now available on supermarket shelves.

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.

Issue No. 3 - Evaluation and pre-breeding of canola varieties for tolerance levels to dim herbicide chemistry could lead to improved ryegrass control and reduce the risk of crop damage resulting in increased profitability and increased area of canola production.

In states where Roundup Ready® canola technology is not available, options for managing herbicide resistant annual ryegrass are limited and tolerance to higher rates of dim chemistry (butroxydim or clethodim) are a useful tool. However, tolerance of varieties and herbicide damage varies across environments and seasons. The risk, damage and impact are higher for less tolerant canola varieties. Knowledge of tolerance levels would enable growers to avoid damaging sensitive cultivars at current label rates. The information could also be used to support label rate variations on specific tolerant varieties and support pre-breeding programs for improved tolerance to dim herbicide chemistry.

GRDC investments addressing this issue

At the time of writing, a list and summaries of any GRDC investments addressing this issue was not available.

Issue No. 15 - Increased seasonal climate variability creates extremely contrasting growing seasons and requires adaptive, agile and flexible management options to optimise yield and maximise profit including but not limited to a "menu" of crop species and cultivars.

The medium rainfall zone experiences a high level of variability. Being able to quickly adapt from one season to the next is difficult for example a decile 1 season requires vastly different management tactics for crop &variety choice; in season crop nutrition, weed, pest and disease management than a rainfall decile 7 season. Supporting growers to be adaptive and agile for each season type will enable yield and profit optimisation while managing risk. This can be done with decision support tools and extension tailored to specific agro-ecological zones within the southern region.

GRDC investments addressing this issue –

Using seasonal forecast information and tools to manage risk and increase profitability in the Southern Region	This investment aims to establish a participatory pilot program to develop and promote tools to better use Bureau of Meteorology weather data and seasonal outlook forecasts. A small group of advisors will be up-skilled and their knowledge and experiences used to better understand the implications of seasonal forecasts and strategies to manage risk and increase profitability. The information generated from the program will enable the development of guidelines and "rules of thumb". It is expected that this investment will draw upon and add value to existing related investments including the outcomes of the Managing Climate Variability R&D Program and the Forewarned is forearmed: equipping farmers and agricultural value chains to proactively manage the impacts of extreme climate events Rural R&D for Profit investment.
Optimised Canola Profitability (CSP00187)	This project has undertaken physiological and agronomic research across 9 regions from southern QLD to the Eyre Peninsula designed to increase canola profitability and reduce production risk with tactical agronomy advice underpinned by crop physiology insights. In Phase 1 of the project (2014-2016), we have focussed on three main strategies to increase canola productivity and profitability - (i) develop robust, higher-yielding early sowing systems (ii) reduce canola production risk in low rainfall areas (iii) better manage the harvest process to reduce loss and maximise profit The key to (i) and (ii) during Phase 1 has been to firstly identify the optimum flowering window to minimise heat and frost risk at specific sites and to identify the variety x sowing date combinations that achieve the optimum flowering window. In Phase 2 we will seek ways to manage the trajectory of biomass accumulation (of specific varieties) to maximise water-use efficiency, optimise N-use efficiency and minimise the risk of high input costs (e.g. seed costs, N, herbicide types, harvest strategies). Understanding crop development and physiology is also the key to (iii) coupled with the most cost-effective harvest strategies to avoid yield/oil trade-offs. In Phase 2 (2017-2019) we will also conduct further investigations of specific varietal adaptations under specific stress (heat, drought, frost) to further refine further G x E x M synergies that can be captured. We are liaising closely with similar projects in the Western and Southern HRZ regions, the National Canola Pathology Initiative along with breeding companies and NVT outcomes to ensure we capture benefits from other research activities.
Evaluating the potential of long term fallowing to reduce whole-farm production costs whilst maintain profit margin – (UHS11009)	Honours thesis

Optimising the yield and economic potential of high input cropping systems in the HRZ (DAV00141)	This investment will provide knowledge and tools to increase the profitability of canola in the HRZs of the Southern and Western grains regions. An increased understanding of Genotype by Environment by Management (GxExM) interactions will help identify superior, better adapted wheat and canola plant types for the region. This will increase the speed at which new varieties are available to growers either through direct importation from overseas breeding programs or through the incorporation of traits into breeding material specifically suited to the HRZ. Modelling will help quantify the value of new traits to industry. Tools that help understand the risks and opportunities associated with applying costly inputs to crops with high yield potential will be developed through close consultation with growers and advisors.
Management of early seeded wheat (ULA91750)	This GRDC investment will provide growers and advisers in the low and medium-rainfall zones of the southern region will have access to more agronomic knowledge and supporting data to allow them to take advantage of early sowing opportunities with winter and slow developing spring wheats. The investment will provide greater understanding of the optimum time of sowing for new cultivars, risks and impacts of drought during vegetative stages, potential threats from weeds, diseases and pests, opportunities for grazing, and nitrogen management and crop density recommendations.
SARDI Bilateral - MRZ project (9175938)	At least four focus paddocks in the MRZ (400-600 mm rainfall/year) in SA will be identified and monitored for the duration of the project, to understand which paddocks are best suited to particular break crop/pasture options. Two long-term rotational trials established to evaluate different crop sequences on contrasting soil types. The analysed and summarised results of these trials will provide information highlighting the agronomic benefits of each sequence and the economic performance of the various sequences, each year and over the course of the sequences. Agronomic trials addressing key constraints to the adoption of profitable and productive break crops/pastures will be established and managed per year. The analysed and summarised results of these trials will provide information towards optimum and variety specific crop management packages for a range of break crops/pastures.
RPI0000 – Riverine Plains Stubble Initiative – Individual research component	Establishment, assessment, harvest and analysis of four paddock scale experiments to incorporate full spatial chemical and PAW mapping. These experiments will include small plot response trials, paddock NDVI mapping, biomass, soil N and yield mapping, and economic analysis based from using PAW and variable rate nitrogen applications. Key points of the research include: 1. Understand how plant available water (PAW) varies across paddock zones, and if current PA datasets can correlate with PAW, 2. Determine the economic value of variable rate nitrogen application across paddocks, based on zones (informed by PAW variability), and 3. Demonstrate the use of NDVI to inform variable rate applications of nitrogen.

Issue No. 20 - Which is the more economically sustainable option in high land price areas -a crop rotation dominated by high value crops or a more balanced rotation with a mix of cereals, pulses and other land use options?

Growers perceive that it is more profitable to generate income and achieve an acceptable return on investment on highly valued land by growing high value crops such as lentils in close rotation than having a more balanced rotation that manages weeds, disease, pest and chemical residues.

Increasing grower understanding of the impact of crop choice on risk and return may lead to more informed crop choice decision-making.

GRDC investments addressing this issue –

SARDI Bilateral - MRZ project (9175938)	At least four focus paddocks in the MRZ (400-600 mm rainfall/year) in SA will be identified and monitored for the duration of the project, to understand which paddocks are best suited to particular break crop/pasture options. Two long-term rotational trials established to evaluate different crop sequences on contrasting soil types. The analysed and summarised results of these trials will provide information highlighting the agronomic benefits of each sequence and the economic performance of the various sequences, each year and over the course of the sequences. Agronomic trials addressing key constraints to the adoption of profitable and productive break crops/pastures will be established and managed per year. The analysed and summarised results of these trials will provide information towards optimum and variety specific crop management packages for a range of break crops/pastures.
Benchmarking and validating the yield gap in each agro-ecological zone (CSA00055)	This project is part of a GRDC initiative to reduce by a third the yield gap in each GRDC region by 2025 through an increase in water productivity. By 2021, the project will contribute to this initiative outcome by quantifying the yield gap and identifying the scope for improvement in each GRDC region. Specifically, this project will develop and implement a legacy plan for the Yield Gap Australia (http://www.yieldgapaustralia.com.au) website to ensure the ongoing availability of maps and a benchmarking tool for growers and advisers. Building on the results of CSA00042 for Australia's wheat and canola crops, the project will produce data, maps and a written report quantifying the current and potential levels of water productivity and the exploitable gap between actual and potential yield for sorghum, barley and the major winter pulses in each AEZ. The credibility of water productivity calculations will be ground-truthed by reviewing and collating the data from CSA00042, BWD00025 and other relevant projects. The causes of the gap between potential and actual yields will be identified through simulation. These data and maps will serve as a benchmark against which future productivity improvements can be assessed. The Yield Gap Australia website will be updated to include potential water productivity and yield gap analysis for sorghum, barley and the winter pulses for the period 1996 to 2013 for the entire Australian cropping zone at the level of individual SLAs (and up-scaled to GRDC's AEZ and regions). Spreadsheets of the data and water productivity analysis will be made available to the GRDC for reuse as a benchmark for future water productivity research and development work. By engaging with at least 10 local growers and 3 advisers in each of 14 grain-growing SLA's the project will collect data and develop a written report for each SLA to: 1. validate current yield gap estimates from the Yield Gap Australia website – are they realistic; 2. identify the biophysical, social or economic constraints to growers reducing the yield gap; 3. identify a hierarchy of constraints to closing the yield gap, 4. identify management practices which will improve water productivity and close the yield gap. On-going increases in the productivity of the grains industry will be difficult to achieve until the causes of unrealised potential are identified and quantified so that appropriate (financially viable) management solutions can be identified and implemented by growers. Two data sources will be investigated to identify the causes of yield gaps. At a national scale the GRDC National Paddock Survey Initiative (BWD00025) data have detailed information on paddock yields and paddock inputs and soil properties as well as observational data on biotic stress symptoms, weed populations etc. At a regional scale Department of Economic Development, Jobs, Transport and Resources (DEDJTR) has undertaken a detailed paddock survey in Western Victoria (Mallee, Wimmera and high rainfall zone), where a comprehensive range of variables including biophysical factors such as soil properties and disease, varieties and grower management have been measured.

	The combined data sets provide an opportunity to assess the relative importance of each of environment, cultivar and management to the (water limited) grain yield of wheat in grower paddocks. This component is a proof of concept study whereby the significant data set already collected from the DEDJTR survey, together with the national data from the GRDC Paddock Survey project, will be used to develop an evidence based approach to identifying and managing the principal causes of the yield gaps at the paddock level for use by advisers and policy makers. The data and analysis from identifying the causes of yield gaps and from the survey of the 14 SLAs will be used by the project economist to develop a risk-return framework which can be used to guide grain growers through the stepwise process of closing the yield gap while allowing them to work within the limits of their aversion to risk. A written report, building on the data for each of the 14 SLAs, will quantify the economic value of the cost of the yield gap and the cost: benefit of implementing management practices to close the yield gap. The analysis will consider: 1. the trade-off between maximising water limited yield vs maximising profit vs maximising utility under risk-aversion, 2. the extent to which both risk and risk-aversion affect yield and profit maximisation; 3. a risk-return framework which incorporates yield response, probability theory, finance techniques and risk-aversion analysis, 4. the effect of economic-risk trade-offs and farmer risk-aversion on closing the yield gap.
P0000001 - Identifying the key production and profitability drivers using commercial paddocks – Victorian Mallee	The project aimed to: 1. identify the key drivers of production and profitability in the Victorian Mallee during 2014-2016; 2. obtain a greater understanding of growers' commercial experiences to Green Peach Aphids and the frost events; 3. determine the impact of time of sowing on the performance of certain crop types and varieties
Understanding the implications of new traits on adaptation, crop physiology and management of pulses in the southern region (DAV00151)	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 and France 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. Variety specific agronomy packages will also be developed. 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.

Issue No. 33 - Registration of short residual imi-herbicides to control of problem weeds in lentils reduces the risk of herbicide residue damage in cereals and the off-label use of other short residual group B herbicides in lentils.

Related issue - **The current processes for pesticide legislation and governance within APVMA restrict timely access to pesticides can negatively impact on crop production and profit**

The over-use and reliance on herbicide strategies increases the rate at which resistance develops and reduces the efficacy of herbicides. This has resulted in an increase in the number and distribution of "hard to kill" weeds. Adoption of integrated weed management packages which include non-chemical strategies may be re-energised by developing novel technologies and tools such as robotic weeders to identify and implement targeted control of hard to kill weeds.

GRDC investments addressing this issue

Not within the GRDC mandate as this is a policy matter dealt with through both the APMVA and legislation which is managed by the Dept. of Agriculture and Water. Policy issues need to be through grain grower representative groups such as GPA and GGL.

GRDC may provide scientific comments on APMVA documents and does so where there are documents for public comment such as registration public release summaries (PRS), chemical review and trade advice notices (TANs).

GRDC invests with the agrochemical industry where a) there is market failure and b) the investment will address data deficiencies identified in any review. E.g. paraquat working with Syngenta, omethoate and dimethoate – no investment as companies are addressing Arista and FMC respectively.