

HoRiZon

Australia's High Rainfall Zone: the new grain Horizon

ISSUE 1, SEPTEMBER 2010

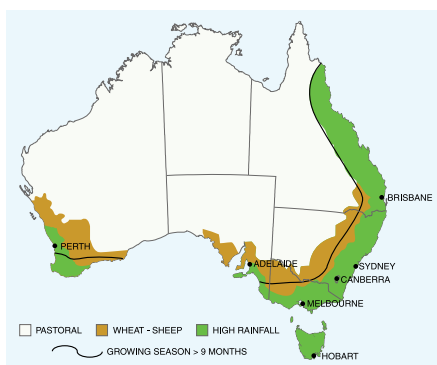
NEW HORIZON for Australian cropping

The high rainfall zone (HRZ) in Australia's northern, western and southern grain growing regions is increasingly recognised as an area of significant potential expansion for grain production.

As rainfall becomes more variable over the next 30-50 years, farming areas that have previously been too wet for cropping may become the most productive.

Yields currently being achieved in these areas are still well below their potential, however there is enormous opportunity to improve.

The high rainfall zone is different to other grain growing areas because it has a longer growing season and provides more options for growers, including being able to sow crops in autumn or spring, and the use of dual purpose crops for cropping and grazing.



The Grains Research and Development Corporation (GRDC) has invested significantly in strategic research in the HRZ over the last eight years and there are a number of specific areas where the GRDC strongly believes productivity and profitability can be enhanced.

Productivity increases may be achieved through the adoption of new technologies such as adoption of raised beds, controlled traffic farming, improved canopy management, management of water and nutrient movement, removing soil constraints and the use of integrated pest management. Growers are also able to maximise yields by adopting cropping best practice in areas such as weed management.

As well, there are unique landscape challenges in the HRZ, and any expansion of cropping in the HRZ should include recognition of the potential environmental impacts on native vegetation and water resources.

However, above all, it's important that the outcomes of GRDC research projects in this area are effectively communicated.

This newsletter is one of a number of initiatives to make this research work more accessible to those already growing grain in the HRZ, and those who have the potential to do so in the future.



Martin Blumenthal, GRDC manager agronomy, soils and environment, and Tanya Robinson, GRDC project manager practices and manager of GRDC's HRZ investment.

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Australia's high rainfall zone is defined as areas where rainfall exceeds one-third of evaporation for nine or more consecutive months of the year.

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All the projects are designed to assist existing grain producers increase their productivity and profitability through realising potential yields, as well as help traditional livestock farmers improve their profitability by growing grain.

GRDC is responsible for planning, investing and overseeing research and development, to drive innovation for a profitable and environmentally sustainable Australian grains industry.

We believe our research in the HRZ is one of the factors that will contribute to a sustainable Australian grains industry in the future.

Martin Blumenthal
GRDC MANAGER AGRONOMY,
SOILS AND ENVIRONMENT

MEET THE RESEARCHERS DR JOHN KIRKEGAARD, CSIRO

Dr Kirkegaard is a Senior Principal Research Scientist and Group Leader of Innovations for Sustainable Farming at CSIRO Plant Industry. He is also Stream Leader of the CSIRO Sustainable Agriculture Flagship.



Dr John Kirkegaard

CURRENT ACTIVITIES

Dr Kirkegaard's current research projects are aimed at improving the productivity and sustainability of farming systems. These include:

- factors limiting canola productivity in southern Australia
- improving whole-farm water-use efficiency including improved subsoil water use by crops
- evaluating biofumigation potential of Brassica cover crops
- harnessing soil biology for improved crop performance.

BACKGROUND

Dr Kirkegaard joined CSIRO as an agronomist in 1990 to improve the productivity and sustainability of dry-land mixed farming systems in southeast Australia.

Key research has included understanding the rotational benefits of Brassica (a genus of plants in the mustard family) crops including biofumigation and biological drilling

and improving crop performance under conservation cropping systems involving direct drilling and stubble retention.

Recent research has focused on:

- the way in which soil biology can be harnessed for improved crop production
- investigations of improving the subsoil water use by crops on a range of soils
- investigations of factors associated with poor performance of canola in southern Australia.

ACADEMIC QUALIFICATIONS

Dr Kirkegaard graduated from Agricultural Science at the University of Queensland, Brisbane in 1983.

He was awarded a Doctor of Philosophy from the University of Queensland in 1990 where he investigated the impact of compaction on grain legume productivity on the Darling Downs, Queensland.

ACHIEVEMENTS

Dr Kirkegaard has been awarded the:

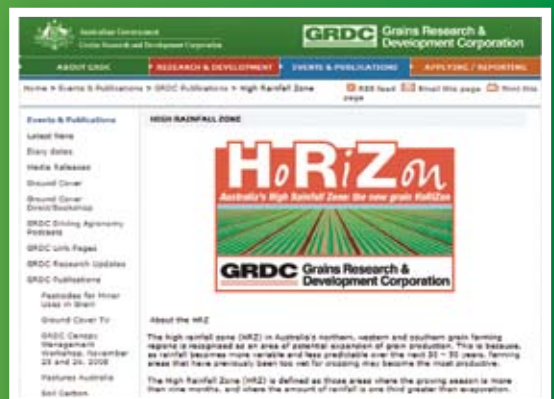
- 2008 Newton-Turner award which is for exceptional scientists who have demonstrated outstanding scientific achievement.
- 2009 Grains Research and Development Cooperation (GRDC) Seed of Light award which recognises excellence and achievement in grains research extension and communication.

(Source: CSIRO)

CHECK OUT GRDC'S HRZ WEBPAGE FOR THE LATEST:

- Project summaries
- Media releases and feature stories
- Electronic copies of HoRiZon newsletter
- Key contacts
- Useful links

VISIT www.grdc.com.au/hrz



PROJECT NEWS

In each issue the HORIZON newsletter will outline the conclusions from key GRDC-supported HRZ projects. For more project summaries, visit www.grdc.com.au/hrz

PROJECT NUMBER:
DAV00056

PROJECT TITLE:
Understanding subsoil constraints in the HRZ

PROJECT SUMMARY:
High rainfall areas of south-east Australia have potential for increased area of crop and high yields. Problems associated with poor soil structure and waterlogging have been noted in the past but the extent of these and other constraints in the high rainfall zone (HRZ) were unknown. Analysis of regional data confirms that the major subsoil constraints are physical due to dense clay subsoils. Also, soil acidity, a topsoil constraint in much of the HRZ, can reach the subsoil if not addressed.

CONCLUSIONS:

Soils in the HRZ

The most common soils in the HRZ are those with strong texture contrast profiles (Sodosols, Chromosols and Kurosols). Physical constraints represented by high clay, high bulk density subsoils are common throughout the HRZ. Compactable A horizons overlying these clay subsoils are also common. Strategies that relieve the density of the subsoils at the same time as minimising the risk of further compaction or re-compaction are needed.

Managing subsoil physical limitations

Results from ripping experiments across the HRZ are hard to compare and interpret given the differences in ripper design, the seasons in which the trials took place, and other

compounding factors such as soil acidity or sodicity. Results from trials have generally exhibited seasonal dependencies with respect to yield with negative and positive benefits in different years.

Waterlogging is a recognised factor in the HRZ but climate variability confounds any predictions to future needs for drainage in southeast Australian arable land. Subsoil waterlogging has certainly been a feature of the majority of soils found in the HRZ but recent experiences with application of bed systems have demonstrated that waterlogging, at least over the last ten years, can be overcome without major subsoil intervention.

Combinations of ripping, drainage, and surface or deep placement

of ameliorants such as lime, gypsum and brown coal, have all been tried in previous research. Adoption of practices modelled on the research has been limited due to high cost, uncertainty of outcome and limited availability of machinery capable of deep tillage plus injection of ameliorants. Recent experimental machinery developed in Western Australia and Victoria is addressing this.

Technology for soil slotting and incorporation of ameliorants pioneered by CSIRO could be applied in the HRZ, but it may be more appropriate in controlled traffic and raised bed systems than for broadacre cropping on the flat. The major impediment to implementation of slotting is the lack of affordable technology.

Soil biology is insufficiently understood with respect to subsoils. Differences between rhizosphere and bulk soil are significant but most management is based on assessment of bulk soil properties.

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The coarse, dense structure in the clay subsoil of a south-west Victorian soil profile limits root growth.



Cropping meets grazing in the HRZ

Replacing 20 per cent of farm pasture area with dual-purpose cereals in high rainfall zones (HRZ) could boost whole-farm gross margins by \$20-45 per hectare, according to Grains Research and Development Corporation-funded research.

Dr Hugh Dove, CSIRO plant industry chief research scientist says further increases in profitability can be achieved by including a spring brassica phase between the pasture and cereal phases.

"In sheep grazing systems, cereal grazing can start when the available crop mass exceeds 1-1.5 tonnes of dry matter/ha, provided the growing tip hasn't advanced beyond 10-15 millimetres above the plant crown," Dr Dove said.

"The amount and digestibility of wheat forage when grazing begins shouldn't limit forage intake or liveweight gain by livestock."

Dr Dove says supplementing young grazing livestock with magnesium and sodium would be "cheap insurance" because of the high potassium, very low sodium and marginal magnesium of wheat forage compared with animal requirements for growth.

He says growers who aim to get 1000 sheep grazing days from

the crop are likely to have minimal impacts on grain yield.

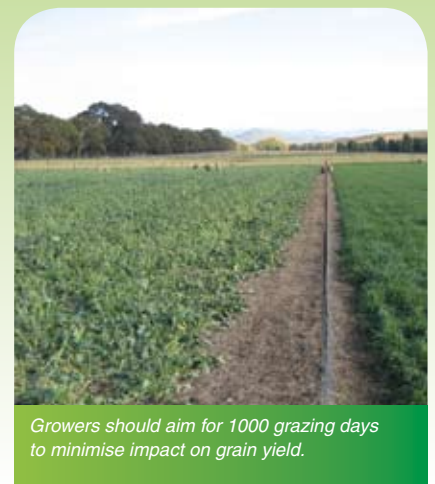
"An example would be 33 sheep/ha for 30 days but higher stocking rates could be used provided the grazing period was shortened correspondingly."

Post-grazing plant growth and development is slower than in ungrazed crops, so key stages such as flowering may be delayed by up to two weeks.

"This may be useful, in terms of avoiding late frosts at flowering, but could also shift grain ripening into a hotter stage of the year and potentially reduce yield," Dr Dove said.

"In general, the effects of crop grazing on subsequent grain yield were small and when stocking rates were 35 sheep/ha or below, they became economically significant at stocking rates of 40-50/ha."

Dr Dove says computer simulation studies over 30 years at three sites show whole-farm gross margins would



Growers should aim for 1000 grazing days to minimise impact on grain yield.

be increased by 20pc if dual-purpose cereal was included with only a small and acceptable increase in the variability of farm income.

"The simulations suggest that results obtained in the HRZ may be transferable to drier climates," he said.

GRDC has invested heavily in HRZ research over the last six years to equip growers with the knowledge and practices needed to increase grain area.

For more information, visit www.grdc.com.au/hrz.



FOR MORE INFORMATION, SEE PAGE 10.

RAISING THE BAR ON RAISED BED CROPPING

Australia's high rainfall zone may become the most reliable grain production area in the country as a result of climate change.

As rainfall becomes more variable and less predictable over the next 30-50 years, farming areas that have previously been too wet for cropping may become the most productive.

The high rainfall zone (HRZ) is defined as areas where rainfall exceeds one-third of evaporation for nine or more consecutive months of the year.

Research undertaken by Professor Robert White, University of Melbourne explored whether grain yield could be reliably increased and to what extent soil changes affected yield.

Professor White says installing raised beds can counter waterlogging – one of the major limiting factors of crop production in the HRZ of south-western Victoria – but it is not economically viable in all situations.

He says the cost of installing raised beds ranges from \$20-33 per hectare per year, so subsequent crops must yield an extra 120-165 kilograms/ha each year to cover setup costs to ensure returns of \$200/tonne.

"The amount of growing season rainfall from May to October determines whether there is any benefit derived from installing raised beds," he says.

"If this is more than 34 millimetres and there is evidence of water lying on the soil surface for extended periods, then raised beds should prove beneficial."

The GRDC-supported research conducted in Victoria's Mt Pollock area found cropping with raised beds is recommended where there is:

- a need to improve the drainage of the land



Installing raised beds can counter waterlogging in high rainfall zone cropping systems.

- the soil surface crusts and sets hard when dry
- the subsoil is clay and sodic resulting in low porosity, poor internal drainage and poor aeration; and
- a likelihood that soil properties, such as soil structure, may deteriorate over time.

In the case of sodic subsoils, incorporation of gypsum into the surface soil when the raised beds are formed will improve the soil structure, Professor White says.

Raised beds are not recommended if there are no historic observations or records of waterlogging; or it is likely that increased crop yields from raised beds will only result in very wet years.

Professor White says there was no significant increase in crop yields using raised beds compared to conventional cultivation during the period of study, which was a period of below average winter rainfall.

"These findings were confirmed by a regional yield survey which showed no clear advantage for raised beds."

Professor White says the GRDC-funded research resulted in better information about the soil physical properties of raised beds, including: soil water retention and release; bulk density; soil strength; hydraulic conductivity; solute transport characteristics; and macropore structure.

The findings have paved the way for further raised bed research including the effect of fertiliser application and canopy management.

"Prior to this project there was no systematic data on the soil water content under raised bed cropping in south-western Victoria," Professor White says.

For more information, visit www.grdc.com.au/hrz.



Disease management HRZ style

New guidelines show delayed fungicide and nitrogen fertiliser applications for the high rainfall zones (HRZ) of Australia's cropping regions can boost profitability.

Nick Poole, Foundation for Arable Research (FAR), New Zealand co-ordinates FAR's GRDC-funded research program in Australia, focusing on canopy management in cereals.

Mr Poole says delaying input decisions from seeding to stem elongation (Growth Stage 30-39) boosts profits because there is a more "complete picture" available on both nutritional requirements and the need for disease control.

"A foliar fungicide applied at GS33-39 to control diseases such as rusts and mildew provides a greater economic benefit than the best upfront seed treatments or in-furrow fungicides applied alone," Mr Poole said.

"The reason is insufficient active ingredients reaching the top three leaves of the canopy from the at-seeding treatments, a finding that was common to both barley and wheat crops."

Mr Poole said to get the most from changing strategies HRZ growers and advisers need to be equipped with the knowledge of cereal plant growth stages at stem elongation, in particular the pseudo stem erect – first node stage (GS30 - 31) to flag leaf emergence stage of development in wheat (GS39) or first awn development in barley (GS49).

"Under high disease pressure in barley, two sprays timed at GS30-31 followed by GS49 where the first awns are emerging on the main stem should be considered over single timings or at-seeding applications."

Mr Poole said growers should consider implementing a disease management strategy particularly for high-yielding, disease-susceptible wheat and barley crops in southern regions of Victoria, South Australia,



Nick Poole, Foundation for Arable Research (FAR), New Zealand co-ordinates FAR's GRDC-funded research program in Australia.

Western Australia and Tasmania or crops that are irrigated.

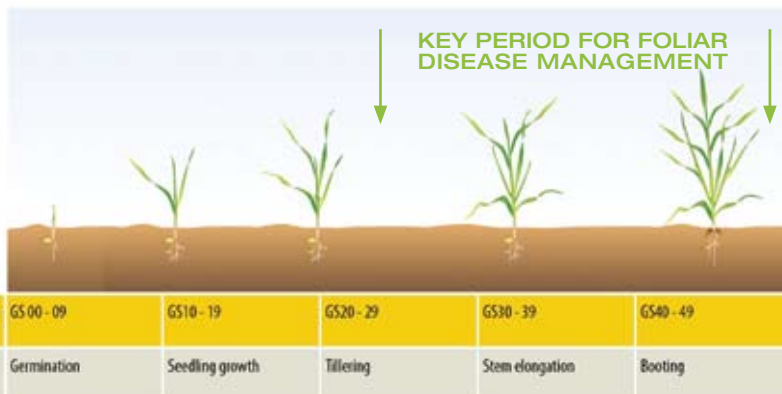
"This is particularly important if nitrogen applications are likely to exceed 60 kilograms N per hectare as nitrogen levels above this rate have been associated with greatly increased disease pressure," he said.

The new practice also offers environmental benefits including using less fertiliser overall and

lower greenhouse gas emissions through more efficient nitrogen use.

GRDC has invested heavily in HRZ research over the last six years to equip growers with the knowledge and practices needed to increase grain production.

For more information, visit www.grdc.com.au/hrz.



BOOSTING WHEAT YIELDS in WA's High Rainfall Zone

Boosting wheat yields in WA's high rainfall zone (HRZ) is a matter of following two simple rules of thumb, according to research supported by the Grains Research and Development Corporation (GRDC).

Perth-based research scientist with CSIRO Plant Industry, Dr Heping Zhang, says the three year research project showed that:

- every 100 ears per square metre produce 1.1 tonnes/hectare of grain; and
- to achieve yield potential it requires one ear/square metre for every millimetre of growing-season rainfall.

Across the four million ha of WA's HRZ the yield potential is about 6t/ha but current yields are about 2.7t/ha.

"We have found that across all rainfall zones of the WA wheatbelt, the number of grains produced per square metre is the single most important component influencing grain yield," Dr Zhang said.

"This is largely influenced by the number of ears per square metre."

He says that current wheat varieties grown in the HRZ are generally sink-limited which means they produce fewer grains per ear than they could potentially fill.

"The research shows increasing sink capacity through agronomic management and breeding is the best way to increase crop yields in the HRZ," Dr Zhang said.

The cultivar Preston Φ , recently released by HRZ Wheats Pty Ltd, was shown to have the capacity to produce a high number of grains per ear with a high ear density.

In terms of agronomic management, Dr Zhang says early sowing provides maximum opportunity to utilise the longer growing season in the HRZ but there is a risk of frost at flowering, so cultivars need to be appropriately adapted.

"High soil fertility accumulated during the long pasture phases typical in WA's HRZ means that high grain yields can be achieved without applying high rates of nitrogen in the first year or two of cropping," Dr Zhang said.

"Nitrogen application rates need to be adjusted according to the initial soil nitrogen and growing-season rainfall.



One ear per square metre for every millimetre of growing season rainfall is needed to achieve yield potential.

"Optimum seeding rate is about 120 kilograms/hectare and phosphorus management of crops after pastures may be more important than nitrogen management, although nitrogen becomes important in the event of waterlogging."

Dr Zhang says the HRZ is expected to become significantly more important to the Australian grains industry as the traditional wheat belt becomes drier with climate change.

"There is a significant need to examine the likely impact of climate change on the growth and yield of wheat in the HRZ as well as on aspects of the wider farming system," he says.

For more information, visit www.grdc.com.au/hrz.



DRIER SEASONS & BETTER DRAINAGE

Victorian scientists are combining climate history, international know-how and the latest breeding material to unlock the full potential and improve profitability of growing wheat and canola in the high rainfall zones (HRZ) of southern Australia.

Drier seasons and better drainage technology has seen significant expansion of cropping in the HRZ of south-eastern Australia, but research suggests production could be boosted by another 25-50pc.

With funding from the Grains Research and Development Corporation (GRDC), Penny Riffkin, Department of Primary Industries (DPI) Victoria senior research agronomist has been working with a team of scientists to boost grain yields in the HRZ.

For the last year 10 years, Penny has been comparing crop development in the HRZ to other national and international cropping regions, quantifying the potential crop yields for the HRZ and how genetics and management may need to change to achieve better returns for farmers in high rainfall regions.

HRZ grain growers are able to sow in autumn or spring and have the option of grazing crops, which means the management decisions are often complex.

"The HRZ is quite different from traditional cropping areas in the rest of Australia. These regions have a much longer growing season, which provides a lot more options for growers," Penny said.

"We have used crop simulation models to help growers identify which options are most likely to give greater yields and returns.

"At the start of our current research project, we held a series of workshops with growers in high rainfall areas

to identify different management strategies they would like us to investigate using the crop models.

"Strategies included time of sowing, nitrogen fertiliser, stubble management, opportunity cropping, irrigation and grazing of crops."

Data was collected over a two-year period from seven on-farm case studies to provide input data for the models and to test how close simulated data was to observed data obtained in the field.

Sites included Meredith, Dunkeld and Miniera in Victoria, Launceston and Campbell Town in Tasmania and Frances and Millicent in South Australia.

The models simulated field results within acceptable error margins which gave confidence that they could be used to investigate strategies under long-term simulations.

From these long-term simulations, the Victorian DPI with the help of Southern Farming Systems (SFS) and Mackillop Farm Management Group developed a series of fact sheets showing the impacts of different management practices on crop yields in the HRZ.

The fact sheets were launched in May 2010 and are available on the SFS and Mackillop Farm Management Group website.



Drier seasons and better drainage technology has seen significant expansion of cropping in the HRZ of south-eastern Australia.



Researcher Penny Riffkin is working to boost HRZ crop yields.

“The HRZ is quite different from traditional cropping areas in the rest of Australia. These regions have a much longer growing season, which provides a lot more options for growers.”

into better adapted varieties in the HRZ of Australia. Ten cultivars are currently under evaluation at four locations across south-west Victoria.

“We know that by using international germplasm, there’s an opportunity to increase yield by up to 20pc which is great news for growers in the HRZ,” Penny said.

“The yield potential in the HRZ is high but we need to identify crops and management practices that can consistently give growers higher yields and profits.

“The key to achieving good yield potential in the HRZ is better adapted germplasm, but we need to guide farmers with their management techniques so they can manage their crops and resource base to get the best returns.”

Penny is also working with wheat physiologists from the United Kingdom to develop an ideal wheat crop for the HRZ.

“We’ve been looking at designing a wheat crop that is best able to capture resources available in the HRZ such as rainfall and sunlight and convert these efficiently into grain,” Penny said.

“Different phase durations in the crop’s life cycle are also identified so that crop development is timed to minimise the crops exposure to climatic risks such as frost, heat and drought.

“The benefit for growers is that this tool has the potential to develop adaptable crop types for changing environments, which may occur with climate change.”

Penny is also comparing research on canola crops in Victoria’s HRZ with winter canola types from Europe.

“Some European canola varieties have very high yield potential but these are not commercially available in Australia,” Penny said.

“We have tested some European germplasm at Hamilton and are finding this new germplasm is out-yielding existing crops by up to 20pc, even though Hamilton has recently been through some really tough, dry seasons.”

Penny wants to do further testing, looking at more cultivars to identify some of the crop characteristics that are contributing to yield increases so that these can be incorporated





DUAL PURPOSE CROPS BOOST HIGH RAINFALL ZONE RETURNS

The use of dual purpose crops in grazing systems in the high rainfall zones (HRZ) of NSW could potentially offer the state's agriculture industry an extra \$150 million per year.

That's the finding of three CSIRO scientists, Dr Hugh Dove, Dr Walter Kelman and Dr John Kirkegaard, who have been looking at the use of dual purpose crops in the HRZ to fill winter feed gaps without compromising yield.

With funding from the Grains Research and Development Corporation (GRDC) and the Grain and Graze initiative, Dr Dove and Dr Kelman began extensive research on wheat in grazing systems in Harden and Marrar, NSW and Ginninderra, ACT in 2004.

Their research addressed a key question: why liveweight gains were so unpredictable in livestock in grazing systems?

Based on previous research conducted in America, Dr Dove also collaborated with Dr Guy McMullen, Industry and Investment NSW (I&I

NSW) to assess the possibility of supplementing wheat with magnesium to achieve liveweight gains in livestock.

"In all bread wheats, there's a gene called Kna1 which results in the wheat plant excluding sodium from its leaves and accumulating potassium. Forage with a high potassium to sodium ratio like this will greatly reduce the magnesium absorption rate in livestock," Dr Dove said.

"From a livestock point of view, this is disastrous for animals, because a low magnesium absorption rate is bad for the overall health of the animal.

"We therefore investigated weight responses to magnesium supplements of sheep grazing dual-purpose wheat. Responses to sodium supplements were also studied, because almost all dual-purpose



Hugh Dove

wheat forage is deficient to very deficient in sodium.

"Seven trials later we found that to get the best performance out of growing animals on winter wheat, producers need to supplement crops with magnesium and/or sodium."

In the meantime, Dr Dove, Dr Kelman and Dr McMullen pinned down the



“The message to growers is this: if you incorporate dual-purpose wheats in the HRZ you’ll make money; and if you supplement the animals when they are grazing wheat you’ll make even more money.”



Dual purpose crops can boost profits.

best management techniques for grazing wheat in winter, including timing as well as grazing the optimum number of animals.

“The message to growers is this: if you incorporate dual-purpose wheats in the HRZ you’ll make money; and if you supplement the animals when they are grazing wheat you’ll make even more money,” Dr Dove said.

“Introducing grazing wheat is very valuable to the industry: every one pc increase in liveweight gain injects \$1m per year into NSW agriculture. This translates across NSW as \$150m per year arising from the grazing of dual-purpose wheat.

“To break that down even further, for every dollar invested in supplements, the individual farmer can earn \$15-20, which is a very good return on investment.”

While Dr Dove, Dr Kelman and Dr McMullen were completing their research, Dr John Kirkegaard

conducted similar research using canola for grazing livestock in winter, followed by oilseed production.

His research showed that choosing varieties appropriate for the date and location of sowing, and careful grazing management during winter are the keys to maximising the value of dual-purpose canola in the HRZ.

So far, canola and wheat have been investigated separately, but over the next three years, further funding from the GRDC will allow Drs Dove, Kirkegaard and Kelman to complete a project which brings the two research streams together.

“Our next project focuses on an integrated system that takes the animals from pastures to canola, to wheat, and then back to pastures,” Dr Dove said.

The three scientists have four experiments taking place across several farms this winter including Canberra, Delegate, Goulburn, south-

west Victoria, southern Queensland and Western Australia:

- 1 Livestock grazing pasture over winter
- 2 Livestock coming off pasture and grazing wheat for 4-5 weeks
- 3 Livestock coming off pasture and grazing canola for 4-5 weeks
- 4 Livestock coming off pasture and grazing canola, then wheat, then back to pasture

“By moving the stock to wheat and canola, we spell the pasture for four to five weeks and then again for an eight to ten week period,” Dr Dove said.

“The benefit of grazing high biomass crops in between resting the pasture will hopefully mean that spring comes early, benefitting the farmer financially.

“I’ll be interested to see the live weight gain of two crops in sequence and how much pasture can be accumulated when it’s rested and the animals are off it.”

GRDC: Supporting HRZ Research

TITLE	PROJECT NO. and YEAR OF COMPLETION	CONTACT
Assisting growers achieve yield potential in the HRZ of south-eastern Australia	DAV00083 2010	Penny Riffkin DPI Victoria Research Agronomist Ph: 03 55730926 penny.riffkin@dpi.vic.gov.au
Management of High Rainfall cropping to improve Water Quality	DAV00059 2009	Dr David Nash DPI Victoria Senior Research Scientist Ph: 03 5624 2222 david.nash@dpi.vic.gov.au
Delivering high yields of milling wheats in the HRZ in WA	CSP00065 2008	Dr Heping Zhang CSIRO Plant Industry Research Scientist Ph: 08 9333 6497 heping.zhang@csiro.au
Evaluating the potential for dual purpose (grain/graze) canola in the mixed farming systems of southern Australia	CSP00085 2010	Dr John Kirkegaard CSIRO Plant Industry Senior Principal Research Scientist Ph: 02 6246 5080 John.Kirkegaard@csiro.au
Investigating stubble management systems to reduce dependence on burning in the HRZ region of Sth Australia	SFS00014 2008	Southern Farming Systems Ph: 03 5229 0566 office@sfs.org.au
Genotype and management combinations for highly productive cropping systems in the HRZ of Sth Australia	DAV00061 2007	Penny Riffkin DPI Victoria Research Agronomist Ph: 03 55730926 penny.riffkin@dpi.vic.gov.au
Increased farm profits in the HRZ using mixed cropping/ grazing systems	CSP00009 2007	Dr Hugh Dove CSIRO Plant Industry Chief Research Scientist Ph: (02) 6246 5078 hugh.dove@csiro.au
Understanding sub-soil constraints in the HRZ	DAV00056 2006	Richard MacEwan Senior Research Scientist DPI Victoria Ph: 03 5430 4326 richard.macewan@dpi.vic.gov.au
Environmental impacts of raised bed cropping in south-west Victoria	DAV417 2006	Tim Johnston DPI Victoria Research Scientist Ph: 03 52264723 tim.johnston@dpi.vic.gov.au
Scoping study for further trials on atrazine use in raised bed farming	NSP00001 2008	Natural Solutions Ph: 07 3124 9400

TITLE	PROJECT NO. and YEAR OF COMPLETION	CONTACT
Change in soil properties under raised bed cropping	UM148 2005	Professor Robert White University of Melbourne School of Land and Environment Emeritus Professor Ph: 03 94973106 robertew@unimelb.edu.au
Optimising cereal profitability in the HRZ through integration of disease management	SFS00015 2008	Southern Farming Systems Ph: 03 5229 0566 office@sfs.org.au
Wheat breeding for HRZ of Australia	CSP00019 2007	Dr Richard Richards CSIRO Plant Industry Program Leader Ph: 02 6246 5090 richard.richards@csiro.au
Breeding dual purpose feed wheats for the high rainfall zones	CSP00101 2010	AUSGRAINZ (c/o CSIRO Plant Industry) Dr Richard Richards CSIRO Plant Industry Program Leader Ph: 02 6246 5090 richard.richards@csiro.au
Optimising economic yield responses through disease management in winter cereals	SFS00006 2005	Southern Farming Systems Ph: 03 5229 0566 office@sfs.org.au
Pest suppressive landscapes: linking IPM and natural resource management	CSE00051 2010	Nancy Shelhorn CSIRO Senior Research Scientist 07 3214 2721 nancy.schellhorn@csiro.au
Dual purpose crops in the HRZ	CSP00132 2012	Dr John Kirkegaard CSIRO Plant Industry Senior Principal Research Scientist Ph: 02 6246 5080 John.Kirkegaard@csiro.au
Biodiversity management in high intensity agricultural landscapes for conservation and provision of ecosystem services	CSP00134 2013	Andrew Young CSIRO Senior Principal Research Scientist Ph: 02 6246 5318 andrew.young@csiro.au
Maximizing crop yield in the HRZ of WA through efficient use of water and nutrients	CSP00128 2012	Dr Steve Milroy CSIRO Plant Industry Research Group Leader Ph: 08 9333 6680 steve.milroy@csiro.au

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