Acknowledgements

This is really a chance for the Riverine Plains to thank those people who have contributed to the research and development progress within the region.

The same names keep cropping up, as people who contribute so much to the group. They are not only the farmer co-operators across the region who support the trials and demonstrations. Some of them are current committee members, some have served their time in the past, but they give energy, time and passion to the cause. Then there is the group of agronomists and consultants who work across the region who are no less passionate about agriculture.

Our sincere appreciation to consultants John Sykes, Tim Paramore and Peter Baines. Thankyou also to John Seidel from Serve-Ag, and to some of the private agronomists representing agribusinesses across the region for generating worthwhile discussions at events. In tandem with farmer queries, this is where original ideas start before they become research needs that need to be addressed.

Thank you to DPI Victoria and NSW DPI agronomists and researchers, some of whom have made their mark on the Committee as Executive support. Dale Grey and Michelle Pardy's trial-work has once again made a huge contribution to this year's book.

Riverine Plains Inc continues to find new links with both NSW DPI and now the Graham Centre at Wagga (a joint venture between DPI and Charles Sturt University and led by Dr Deirdre Lemerle) and also with the DPI Rutherglen Centre and the University of Melbourne Dookie campus, coordinated by Ken Young. We also collaborate with Sydney University staff such as Brett Whelan from the Australian Centre for Precision Agriculture, and research scientists from CSIRO Canberra.

There is so much going on already in the greater region of Riverine Plains. If you hear about somebody doing great work please invite them to contact us. We would like to involve them and know that as an established group we are enthusiastic about the sharing of information, both through the distribution of this annual compendium and also at events.

It is high time to recognise that farming and agricultural research in the Riverine Plains is innovative and exciting, and shouldn't be stereotyped by anyone as traditional or conservative.

Lisa Cary Castleman
Editor

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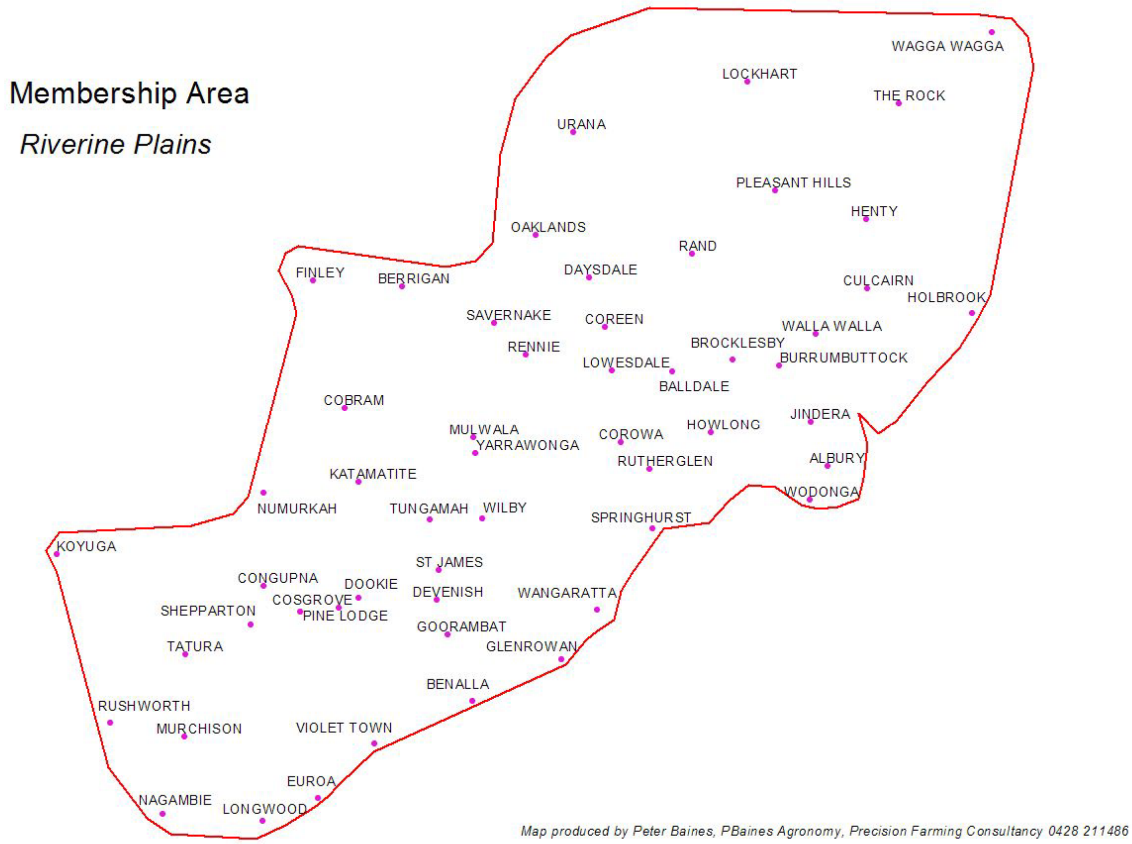
Area Covered by Riverine Plains Inc



2006 Riverine Plains Inc Committee

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Preface

Trials versus demonstrations - what the results mean

Research on the Riverine Plains takes different shapes and forms, each of which has the potential to make an important contribution to increasing the understanding about agricultural systems in the area. However, it is important to keep in mind that results from the different forms of research need to be analysed and interpreted in different ways.

It is important to understand the difference between trials and demonstrations in the use of results for benefit on farms. A replicated trial means that each treatment is repeated a number of times and an average result is presented. The replication reduces outside influences producing a more accurate result. For example, trying two new wheat varieties in a paddock with varying soil types and getting an accurate comparison can be obtained by trying a plot of each variety, say four times. Calculation of the average yield of each variety accounts for variations in soil type.

Statistical tests (eg Analysis of Variance -ANOVA, Least Significant Difference - LSD) are used to measure the difference between the averages. If there is no significant difference between treatments the results will be accompanied by NS (not significantly different). A statistically significant difference is one in which we can be confident that the differences observed are real and not a result of chance. The statistical difference is measured at the 5% level of probability, represented as "P<0.05".

Table 1: Example of a replicated trial with four treatments

	TREATMENT	**AVG. YIELD (t/ha)**
1	Variety 1	4.2
2	Variety 2	4.4
3	Variety 3	3.1
4	Control	4.3
	LSD (P<0.05)	0.5

Table 1 shows an LSD of 0.5 t/ha. Only Variety 3 shows a difference of greater than 0.5 t/ha, compared with the other varieties. Therefore Variety 3 is the only treatment that is significantly different.

A demonstration is a comparison of a number of treatments, which are not replicated. For example, splitting a paddock in half and trying two new wheat varieties or comparing a number of different fertilisers across a paddock. Because a demonstration is not replicated results cannot be statistically validated. (For example, it may be that one variety was favoured by being sown on the better half of the paddock.) Demonstrations play an important role as an extension of a replicated trial that can be tried in a simple format across a large range of areas and climates.

Demonstrations are accurate for the paddock chosen under the seasonal conditions incurred. However, care must be taken before applying the results elsewhere.

Trials and demonstrations play a different role in the application of new technology. Information from replicated trials is not always directly applicable but may lead to further understanding and targeted research. Demonstrations are usually the last step before the application of technology on farm.

INTRODUCTION

A Word from the Chairman

Adam Inchbold, “Grand View”, Yarrawonga

The Riverine Plains area is a significant player in agricultural production in Australia. While, the area is not as vast as some, yields are relatively high for Australian conditions. Production is relatively consistent across seasons, with members describing yields within a range of 2-6 t/ha and most averaging between 3-4 t/ha. The area is well developed, and has a long history of agricultural production, with cropping and mixed farming beginning in the mid to late 1800’s.

Farmers in the Riverine Plains area have a long and proud history of efficiency and innovation, being speedy adopters of technology and new practices. In the late ’70s and early ‘80s, direct drilling for instance was quickly adopted by many of the area’s leading farmers. More recently, the area has become known for its early adoption of GPS technology. Even four years ago, in a general membership survey, 50% of respondents described using GPS technology in at least some aspect of their farming system. Anecdotally, workers in the industry have described the area as one of the real ‘happening’ spots for GPS technology, with farmers being well acquainted with the basic principles, and many having already taken the step to using advanced auto-steer systems.

One of the reasons behind the inception of Riverine Plains Inc was a perceived lack of attention from funding bodies being given to the area for relevant and local Research and Development (R&D). In this sense, Riverine Plains Inc was established to ‘fill a hole’ extension wise, and to try and help attract research dollars for badly needed R&D projects. All this seemed somewhat frustrating given the regions credentials, however, I think I can say that the lack of priority given to the area is in the process of being corrected. There seems to be a growing recognition as to the importance of the area agriculturally, and the willingness of the players to take up technology quickly, and thus reward the research, development and extension funds that are invested.

In line with the above, Riverine Plains Inc announced during 2005, that it had successfully tendered for a new applied R&D project called ‘Improved Winter Cropping Systems in the Riverine Plains’. Worth approximately $150,000 pa for three years, this project will advance our Precision Agriculture knowledge from that which was gained in the previous zonal management project, and will also develop best practice packages for a variety of crops grown on a wheat stubble, colloquially called the ‘third crop’ in the rotation. We were thrilled to have been given this opportunity to continue our applied R&D work, as we believe we now have a proven track record in successfully undertaking these types of projects.

In fact, at the end of 2005, Riverine Plains Inc concluded its first Grains Research & Development Corporation (GRDC) funded project, Zonal Management in the Riverine Plains. Many results have come from this project, including those presented within. Over the last couple of years, results have been presented at conferences in Sydney, Adelaide, and more locally in Wagga Wagga and Bendigo, and of course within our own local area. Riverine Plains Inc has received wide recognition for the results that have come from this project, and the relatively small amount of funding that was required to achieve them.

Applied R&D projects are only one small part of Riverine Plains Inc, however. In fact, I think we would have a rather small committee if that's all we did. So, last year of course we continued and enhanced the extension and service side of what was offered to members. The GRDC farmer update held in February 2005 was one of the best attended in South East Australia, and continued the tradition of bringing cutting edge technologies to farmers. After sowing we once again looked at some seeding systems in North East Victoria, and in the spring held two farm walks to look at stripe rust issues, varieties and results coming out of the third crop project.

In mid 2005 we introduced to the program a business management update which was well attended. It was interesting to see a slightly different demographic attending this day, with topics such as succession and benchmarking on the agenda. The success of this day has given the committee incentive to further develop programs that are more business orientated and in the next year or two we hope to do more in this area, including offering a benchmarking service to members.

At the end of August 2005, around 40 members jetted off to South Australia for a week of diligent studies (in a great wine area!!). This once again proved to be a huge success. It is my belief however, that this is not only due to the program, but also the interaction that occurs 'on the bus' between those attending. Of course all interactions are not always positive, particularly if you find yourself sharing a room with an avid snorer, but on a serious note, they generally prove to be a great experience. It strikes me that Riverine Plains has untapped potential in providing an avenue for this interaction, especially between members that live some distance apart. We will endeavour to pursue this in the future.

Previously at strategic planning sessions, committee members have spoken of the opportunity for Riverine Plains Inc to react quickly to emerging topics to provide relevant and up to date information to its members. In the past, we have taken this opportunity when stripe rust emerged a couple of years ago, and last year, when the break was a little slow in arriving, we held a 'late break' strategy meeting to help members keep their heads a little and think objectively through some strategies and strategy adjustments. Riverine Plains Inc are eager to provide this service when important issues emerge, and are always happy to receive input to jolt us into action.

As we move into our seventh year, it is clear that Riverine Plains Inc has a strong base of support and service provision on which we can build. This base was originally made possible by the strong and loyal support that we were given by our sponsors, initial members and a hard working committee.

With regard to the sponsors, it is important to recognize that in the initial years, without other funding, their support enabled the group to get off the ground and kick start programs like the Precision Agriculture program, that then went on to get funding, giving the group momentum to move forward to where it is now. Sponsors continue to provide generous support to the group, and deserve our sincere gratitude. They really do make a difference.

My thanks also to the continuing work of the committee. It is a pleasure to be part of such a vibrant group. We continue to lure a couple of new committee members every now and then, which is great, and needs to continue to promote committee sustainability. We also continue to receive outstanding support from NSW and Victorian DPI staff. Finally, on behalf of all of you I offer our thanks to a hard working Fiona. Two babies in the time she has been with us, and she is going stronger than ever. More seriously, as the group continues to grow, the work required is ever increasing, and the overall growth would not have been possible without someone as efficient and as capable as Fiona.

From the challenge of getting the group and the region on the map, we have now been given an opportunity. We continue to receive funding support for projects, and private sponsorship for general group activities. We have a strong membership base, and a strong committee. This opportunity then brings the next set of challenges, mainly to do with making the most of our opportunities, by continuing to move forward into the future. As farm businesses, we are constantly examining and challenging ourselves to do better. This needs to be the case for Riverine Plains Inc also. I look forward to this challenge with you all. It's an exciting area!

Annual Report for the Albury Agronomy District - 2005

Author: Janet Wilkins

Contact No: 02 6041 6500

Organisation: NSW DPI, Albury

Note: Rainfall weather data sourced from Australian Rainman Streamflow Version 4

The 2005 year began with a fairly wet summer, as January and February rainfall were well above average (Figures 5 and 7). However from March through to June there was very little rain and no significant falls to allow crops to be sown. Good rain from June through to the end of the growing season increased the yield potential of many late sown crops resulting in above average yield for the district. A dry December and late harvest meant grain quality was generally good.

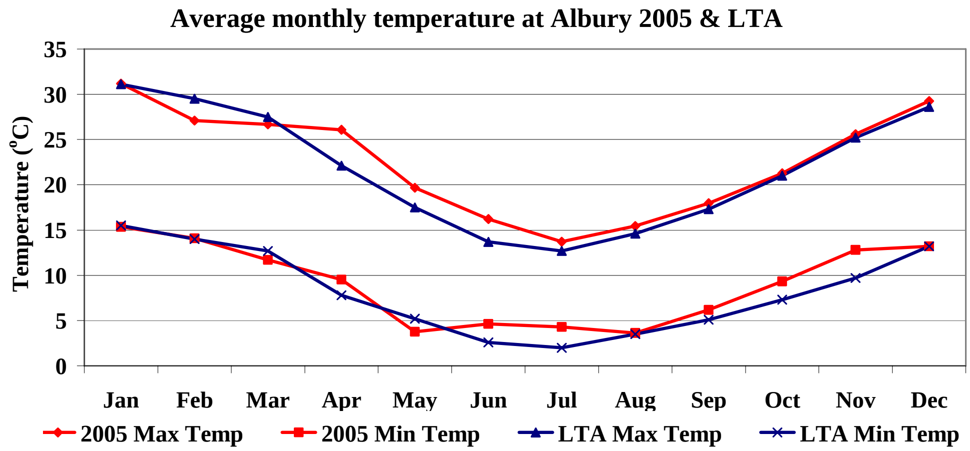


Figure 1

Average monthly maximum temperatures were slightly above the long term average (LTA) particularly from April to July (Figure 1). Average minimum temperatures were above the LTA resulting in a milder winter and a reduced number of frosts for the year (Figure 2).

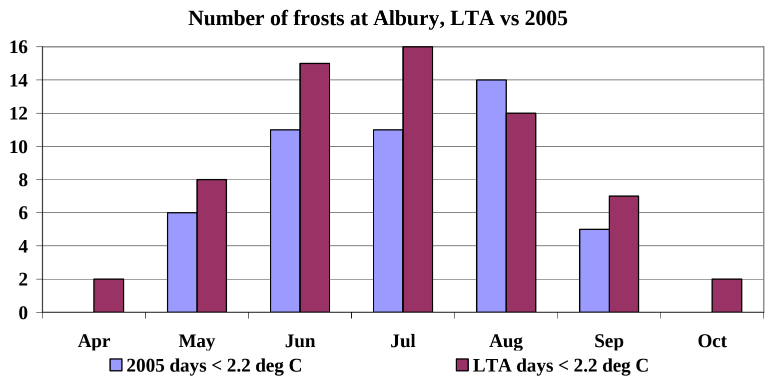
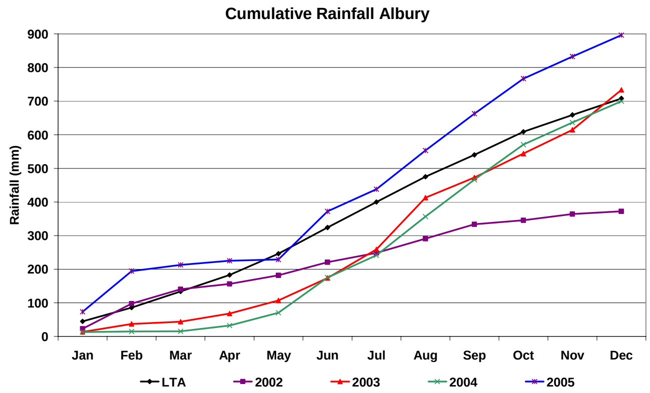


Figure 2

Total rainfall for 2005 was above average for most areas of the district (Figures 3 and 4) with the exception of Holbrook which was just below average. The cumulative rainfall was just below the 90^{th} percentile range (Figures 5 and 7) meaning one of the wetter years on record. However, by comparison the growing season rainfall was well below this 90^{th} percentile range (Figures 6 and 8) particularly on the western side of the district due to the lack of rain in autumn.



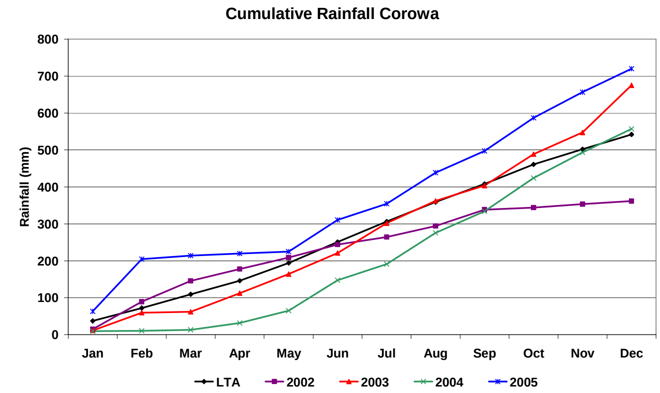
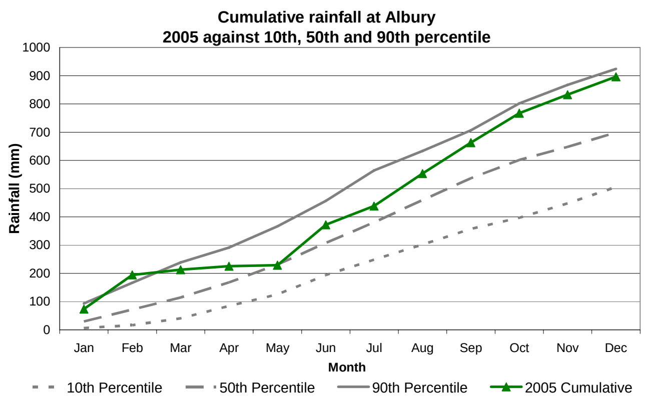


Figure 3

Figure 4



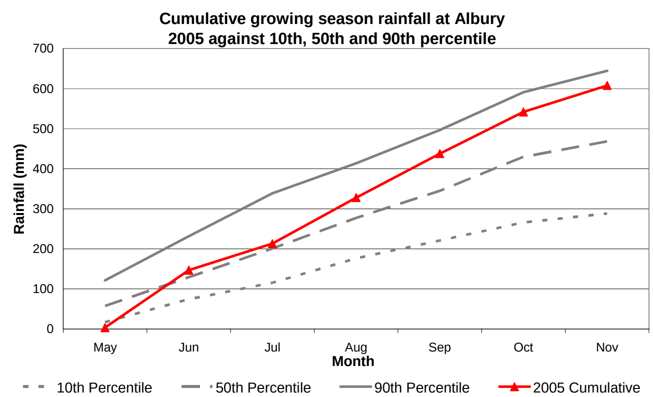
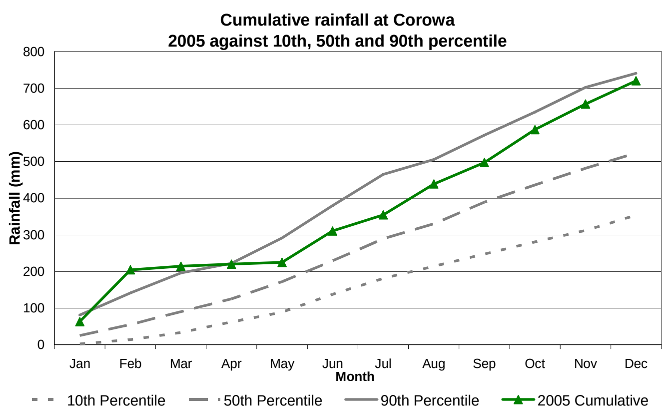


Figure 5

Figure 6



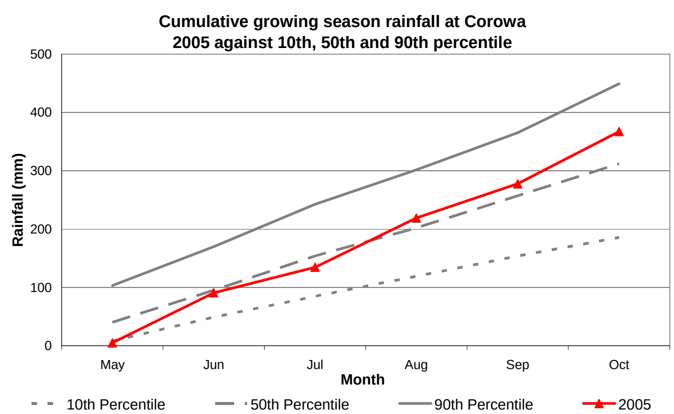
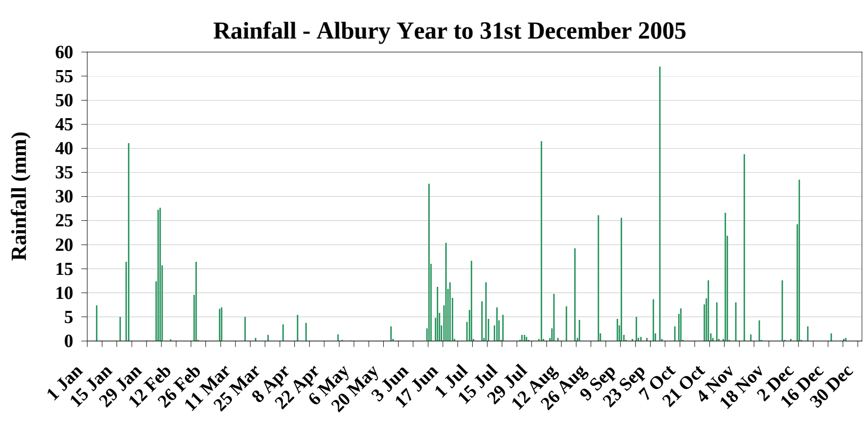


Figure 7

Figure 8

Figure 9



Cropping:
There were very few early sown cereal crops due to the dry autumn. These were restricted to areas receiving isolated rainfall events. Early crops sown on marginal moisture had patchy emergence resulting in uneven crops.

Many crops were dry sown and emerged on the rain in mid June. The continued rain through June and July further delayed the sowing of many crops. The late break also limited variety choices.

For those who had early sown grazing cereals, they provided valuable grazing when there was little other feed available.

Due to the lack of autumn rain there was little chance for weeds to germinate or for weed control before crop emergence. Hence weed control in most crops was less than desirable; particularly toad rush control.

For crops that were early sown in June/July growing conditions were ideal. A period of frosts in August slowed the growth of crops and pastures.

Despite the late break and dry autumn, stripe rust still appeared in wheat crops requiring decisions on foliar fungicides. The continued cool temperatures and moisture in September and October provided ideal conditions for the disease and many wheat crops required multiple sprays to control the disease.

The ideal growing conditions in September and October increased the yield potential of crops in what may otherwise have been a low yielding year. Short season wheat varieties had the better yields.

Canola yields were encouraging with the average yield being 1.6 t/ha and some crops in the east of the district yielding over 2 t/ha. Oil content was good with most crops between 40 - 42%.

Sclerotinia was again a problem in canola and lupins with some crops incurring a significant yield loss. Some lupin crops also had problems with root diseases particularly phytophthora root rot in Albus lupins.

There were some reports from the western side of the district of late sown winter wheat varieties having disappointing yields and pinched grain. Black point was also a problem in some susceptible varieties.

Despite the late start to the season exceptional growing conditions in spring resulted in better yields. The average wheat yield for the district was 4 t/ha with some crops yielding 6 t/ha. With a relatively dry harvest grain quality was generally good.

Pastures:
The summer rain resulted in unusually good growth through February. Some annual grasses and clovers germinated on the late summer rain but the lack of follow up rain slowed growth with much of this early germination failing to persist.

Pasture growth in autumn was minimal with the lack of autumn rains resulting in many pastures being grazed bare. Supplementary feeding continued through well into the winter months.

Pasture growth in June was very low with pastures growing at just 10 kg DM/ha/day through to the end of July.

Increasing temperatures in late August saw pasture growth improve with September and October growth rates increasing to 40-50 kg DM/ha/day on the eastern side of the district and 50-60 kg DM/ha/day on the western side (Corowa area). Newly established perennial pastures and lucerne paddocks did very well given the ideal growing conditions through to the end of November.

Many pastures were cut for hay or silage in October or November. The continued rain in October and November resulted in a lot of poor quality or ruined hay.

The dry conditions over autumn resulted in many bare patches in established perennial pastures. This provided an ideal opportunity for weeds, particularly barley grass, to establish on the June rain. The barley grass in some perennial pastures reduced pasture quality, particularly later in the season.

High pasture growth rates of 80-85 kg DM/ha/day continued well into November. Even with fodder conservation numerous pastures got away, hence many paddocks have quite heavy swards of mature pasture available as dry feed over the summer.

The lack of rain and hot temperatures in late December meant most pastures hayed off by the end of December.

Insert Goldacres full page ad here

RIVERINE PLAINS INC – RESEARCH AT WORK

Making Money out of Zonal Management

Author: Adam Inchbold on behalf of the P.A. Project Team (listed at end of paper)

Contact No: 0418 442 910

Company: Farmer and Chairman of Riverine Plains Inc

Key messages:

- Zones can be initially delineated (boundaries mapped) by using EM38 surveys.
- Check zones from EM38 surveys using other tools which include yield maps, paddock elevation maps and historical (farmer) knowledge.
- Once zones are delineated soil test in zones.
- Use soil test decisions to write input prescriptions.
- Deep Soil Nitrogen (DSN) and crop monitor in zones.
- Test strips are a good approach to testing the profitability of variable rates.
- Yield map! Yield map! Yield map!

Introduction:
Riverine Plains Inc, has previously identified variation in important soil parameters within paddocks. Other workers in Australia have already developed a means by which this information can be brought together with yield maps and other spatial data to delineate management zones within paddocks. However, most farmers are yet to adopt this technique on a commercial scale. Consequently, a project was designed to delineate and ground truth management zones in paddocks in the Riverine Plains and then investigate options to manage these zones more appropriately, according to their own unique characteristics.

Paddocks at three sites across the Riverine Plains were selected as project paddocks. Broadly speaking the sites are at Yarrawonga, Vic ("Grand View" - Inchbold), Burrumbuttock, NSW ("Yaralla" – I'Anson) and Urana, NSW ("Bogandillan" - Hamilton).

Formalizing soil variability
2003 was the first year of this project. In general terms, information that already existed on the project paddocks were combined with an updated EM 38 survey to delineate potential management zones within each paddock. An extensive array of measurements was taken in each zone. In 2003, ground truthing undertaken in each zone included 0-10 cm soil tests, 0-60 cm deep soil nitrogen (DSN) tests, data from in crop monitoring (tiller counts and yields), and soil moisture data using Gopher meters. This ground truthing continued in 2004 and 2005.

In 2004, an effort was made to physically survey the characteristics of the soil across several of the project paddocks at Yarrawonga. The surveyed evaluated the soil monitoring sites already existing in the projected paddocks using all of the known systems of classification including Isbell, Northcote and Great Soil Groups. This survey yielded some very interesting results.

Essentially the properties of the topsoil remained similar across much of the area surveyed, however the properties of the sub-soil changed significantly as the soil surveyor moved down the slope from the tops of the hills through the mid slope to the points of lowest elevation.

The sub-soil characteristics of greatest interest for analysis are considered to be:

1. The presence of sodicity in the profile where soil aggregates disperse;
2. Soil permeability.

On the tops of the hills, the topsoil basically overlaid a mix of B/C horizon (partially broken down parent material) with no A2 horizon present. Moving down the slope, an A2 horizon became present (named a 'chromosol' under the Isbell soil classification system), and then more pronounced. As this was happening the sub-soil became more clayey, and eventually became sodic ('sodosol' (Isbell)).

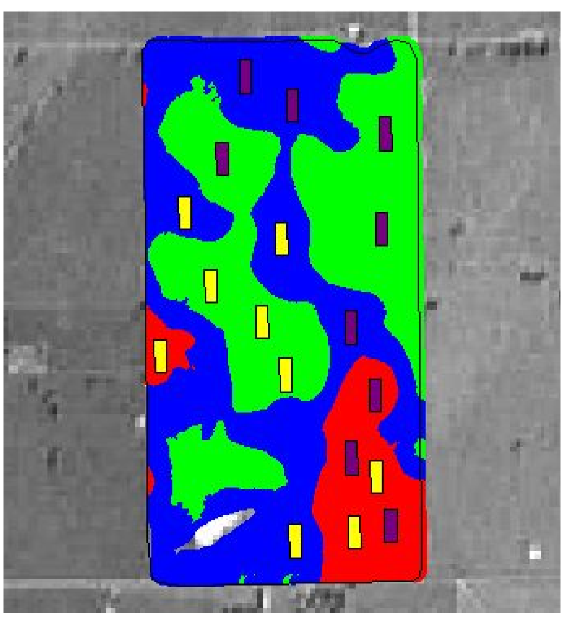
The extent of this variation is highly significant when thinking of the actual characteristics that vary in the soil through these different soil classifications. Many of these properties potentially have a marked influence on production, giving rise to the potential to target different levels of production on these different soil types. An understanding of how these vary across the paddock will provide a key to identifying when and where the crop runs out of available soil water in drier seasons, and where areas of superior drainage benefit in wetter seasons.

Test strips – a common theme

Nitrogen

In 2003, the amount of available N from DSN tests taken from 90 sample sites ranged from 31 to 320 kg N/ha. Statistical analysis of data (analysis of variance) indicated that significant difference occurred between the zones, with no significant difference in values occurring between replications (*$P<0.05$*). This indicated that DSN values were consistent within each zone, and therefore differences in the DSN status between zones were meaningful.

As a result of the significant DSN results, an N fertilizer response experiment was set out, according to the guidelines developed by the ACPA (Australian Centre for Precision Agriculture). This involved the laying out of a replicated N rate trial in each zone to determine the response of each zone to varying rates of N (Figure 10a). Yield maps (Figure 10b) were used to evaluate crop performance across the zones and also to determine the yield results of the test strips. Analysis of the yield response in each zone to applied urea in 2003 performed by Brett Whelan, ACPA, is shown in Figure 11.



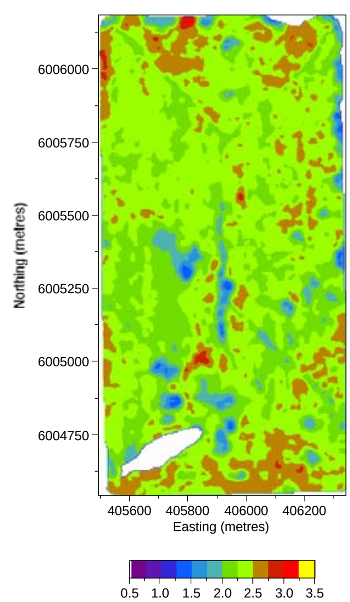


Figure 10. (a) Urea fertiliser application layout – yellow plots received 0 kg/ha, purple plots received 200 kg/ha, rest of the paddock received 100 kg/ha. (b) Canola yield map for 2003.

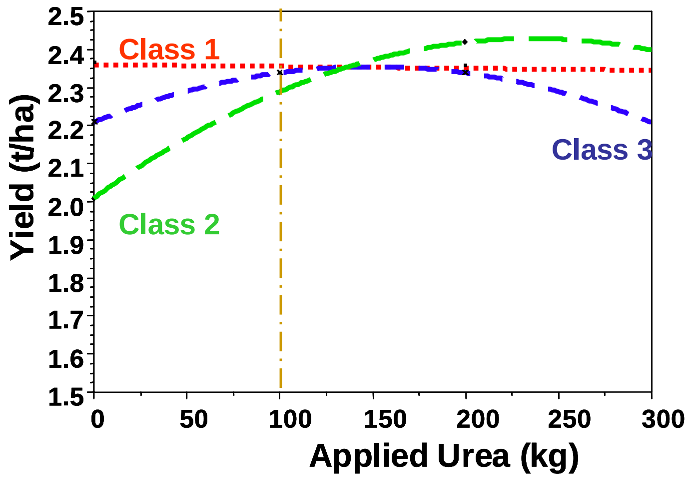


Figure 11. Yield response to applied urea in each potential management class. The paddock average of 100 kg/ha is shown to provide a relatively even yield across the classes, which is confirmed by the yield map.

The yield map is generally uniform across the paddock and this is reflected in the response function analysis. The majority of the paddock received 100kg/ha and the variation between the zones at this rate was calculated to be just 0.1 t/ha on average. However, an economic examination of the response data shows that the output from the different zones would have been optimised by applying different average rates in each. The urea rate for maximum yield and economic optimum urea rate for each zone using a marginal rate analysis is shown in Table 2.

Table 2: Urea rates to achieve maximum yield and economic optimum per management class

	Urea Rate for Maximum Returns (kg/ha)	**Urea Rate for Maximum Yield (kg/ha)**
Class 1 (Red – High EM)	0	0
Class 2 (Green – Low EM)	169	237
Class 3 (Blue – Medium EM)	72	151

Using these response functions it is possible to make a simple estimate of what gains or losses in gross margin would have been made if this information had been used to formulate fertiliser decisions at the beginning of the season. Table 3 documents a comparison with the paddock average treatment of 100 kg Urea/ha.

Table 3: Analysis of gross margin losses from fertilising at 100 kg/ha paddock average

Fertilizer waste	**ha x kg = t**	**x $400/t =$**
Class 1	18 x 100 = 1.8	720
Class 3	59 x 18 = 1.06	424
Yield loss		x $400/t =$
Class 2	53 x 100 = 5.3	2120
Total Loss		3264 (25.10/ha)

As can be seen in the breakdown, in 77ha of the paddock there was more fertiliser used than required, and in 53ha of the paddock an extra application of 69 kg/ha would have brought in over 5 tonne more canola. The total loss in this scenario is $3264 or $25.10 per hectare.

If this information was used at the beginning of the season, the 2.86 tonne of extra urea applied in Class 1 and 3 would have been distributed to Class 2, which would still require an additional 0.8 tonne of urea to be purchased for Class 2. The cost of the extra fertiliser would have been $320 for a gain of $2120 in yield. The difference of $1800 ($13.85/ha) in gross margin would have been gained.

The true result for the 2003 season then (in gross margin terms) is that with this information at the beginning of the season, instead of essentially costing $25.10/ha more for the return it achieved, the paddock could have improved its gross margin by $13.85/ha. The total turn-around in gross margin is therefore potentially $38.95/ha.

In 2004, similar DSN results were observed between zones. This was encouraging as a relatively even yield map had been observed in 2003, giving support to the concept that genuine differences in N status between zones existed. Varying rates of N were applied to a wheat crop in paddock 44 in the same test strips that were used in 2003, to continue to test the varying production potential of the different zones. Figure 12 shows the N response functions for the three zones produced from the yield map of the wheat crop in 2004.

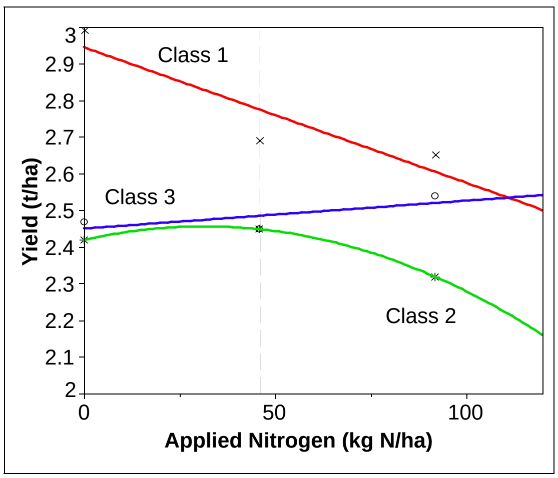


Figure 12. N response functions from wheat crop grown in 2004

2004 had an extremely dry finish to the growing season. Not surprisingly, the high conductivity zone, with its still high N status exhibited a strongly negative correlation to extra N. Extra N in the low conductivity, with its low water holding capacity also reduced yield.

The N response functions for 2005 are shown in Figure 13. 2005 was a much more favourable year. It can be seen that the response functions resemble to a degree those seen in 2003. The low conductivity zone with its poorer soil continues to respond to extra N when there are regular additions to its moisture profile, i.e. in a favourable season. The medium zone with its intermediate N statues also responds to extra N, but the response curve tends to flatten out. The high conductivity zone, with its higher N status, responds the least to N.

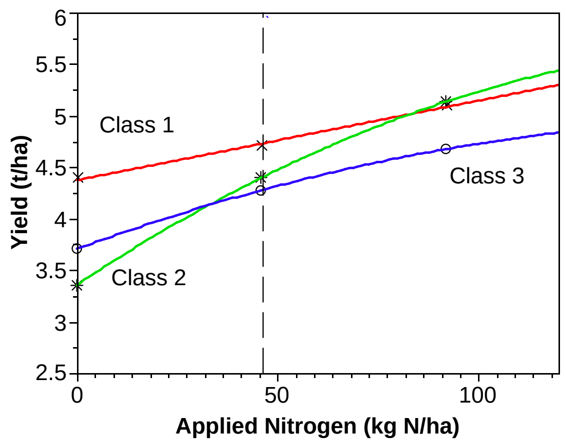


Figure 13. N response functions for 2005 barley crop

Phosphorous

In a similar fashion to paddock 44, test strips were also laid out in zones in paddocks 46 and 49. These strips however have had varying rates on P applied to them in 2004 and 2005. Figure 14 shows P response functions for the 2005 wheat crop in paddock 46. The key aspect here is the significantly different response to extra P in the high conductivity zone (Class 1) compared to the other two zones.

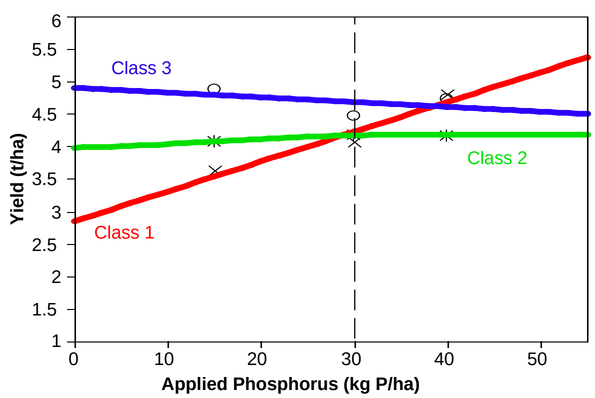


Figure 14. P response functions for three zones in paddock 46

Soil-water, one of the drivers?

Soil moisture tubes are located within management zones at "Yaralla", Burrumbuttock, and "Grand View", Yarrawonga. At each site, at least three moisture tubes are located in each management zone to provide some replication of results. In 2003, 2004 and 2005 soil moisture was measured at 10cm intervals down the soil profile with a moisture measurement sensor down to 1 metre. Readings were taken during the growing season twice weekly.

The soil-water measurements that are being taken are proving to be a highly valuable dataset. It can be seen that the soils in the different zones have vastly different soil-water profiles. This is obviously crucial for a zones ability to yield, and hence the picture that will develop from further measurements in this area will give more insight into an individual zones' ability to yield.

The above is also supported by the results from the test strips. In the end, the test strips in each zone give an indication of the production potential of that particular zone. For example, in a favourable year, the low conductivity zone has the potential to perform as well as the high conductivity zone. However, when moisture is more limiting, the low conductivity zone will generally yield the lowest. The high conductivity zone seems to have the highest inherent potential to yield, as it can store more water.

Results from the N strips in 2005, have been added to DSN results for these strips prior to N application and graphed against yield to give a yield response to total available N for each of the three zones. The difference in response curves between zones is marked, supporting the notion that there is a significant difference in yield potential between zones (Figure 15).

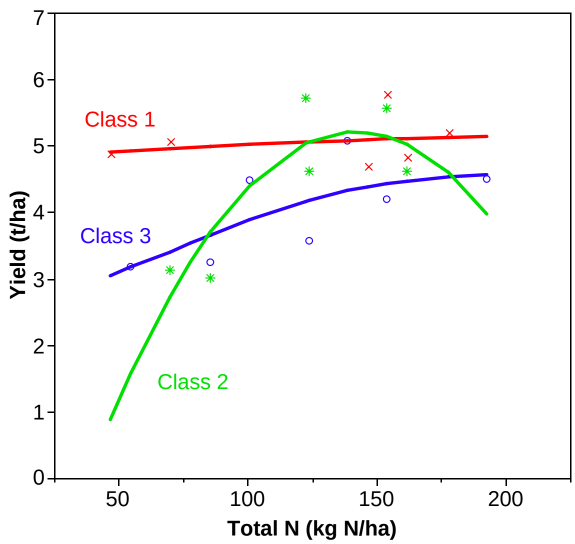


Figure 15. Difference in response curves between zones

This is an area that represents the next step in zonal management. If farmers know which zones have a higher production capability, then different yield targets can be allocated to different zones, resulting in a more sophisticated and more appropriate fertiliser strategy. However, it is important to remember that a very sophisticated variable rate fertiliser strategy requires very good knowledge of a particular paddocks characteristics and variability to guard against costly errors. This knowledge will be built up over time. At this stage, it would seem that there are a number of simpler steps that should be taken by farmers getting into zonal management that don't necessarily require such a comprehensive understanding of their paddocks eg variable rate lime and gypsum applications.

How much money is in variable rate?

Not surprisingly, the answer to this question is dependant on the characteristics of each particular paddock. However, it can be seen from these examples, that paddocks do vary significantly in important production parameters, and that treating these zones differently can result in an improved gross margin. In this project we have seen the potential to make money through variable rate applications of Lime, Gypsum and Nitrogen. Furthermore, a highly complex approach is not required to undertake variable rate applications. Firstly paddocks are split into two or three zones, and then these zones are simply tested as if they were individual paddocks, instead of testing across the whole paddock as an average. Inputs are then applied to individual zones according to their particular test results to achieve a more optimum level of input for the system as a whole. A generic protocol to get farmers started in variable rate has been established by the project team.

The **Generic Protocol for adopting Variable Rate Technology** is as follows:

- Electromagnetic (EM38) survey of the paddock.
- Check EM survey and zones against yield maps, and NDVI (vegetation index) maps etc.
- Ground truth – topsoil and subsoil cores; presence of rock or gravel, depth to B Horizon, colour changes, compacted layers or plough pans, presence of plant roots.
- Zone paddock/s (decide the number of zones **after** survey and ground truthing).
- Develop VR lime, gypsum, P and/or N plots (+/-, standard rates, adjusted rates, need for strips or control).
- DSN test of zones.
- Crop monitoring of zones.
- Yield map.

Extending the message

Aside from the extension of results from this project through general information days, Riverine Plains Inc are extending results from this project to farmers through a series of discussion groups that will give farmers that chance to hear about results from this project, as well as discuss and learn about other PA related issues. Over forty farmers have signed up to be a part of this group from the general membership base. In 2005, Riverine Plains Inc gave the members of the discussion group the opportunity to lay down their own on-farm trial plots to assist in the adoption of zonal management on the commercial scale. This will continue in 2006, with other PA issues such as guidance and controllers also being discussed and evaluated.

Riverine Plains Inc "Zonal Management in the Riverine Plains" Project Team

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Are you making use of all the water available?

Author: Tim Paramore

Contact No: 02 6029 2584

Organisation: Tim Paramore Agronomic Services Pty Ltd, Albury NSW
in association with Peter Baines Agronomy

Aim:
To investigate soil moisture levels in different EM zones through a growing season.

Key messages:
- Water was not used to any great depth (the normal rooting depth) in the heavier soil type zone in the growing season of 2005 thus not achieving potential yield.
- Monitoring soil moisture can give a good indication of possible structural problems to depth through the lack of root development.

Method:
- Insertion of soil moisture sensor data loggers down to a metre into the three EM zones of paddock 44, 46, 49 at “Grandview” (Inchbolds) Yarrawonga.
- Downloading of data at the end of the growing season and construction of graphs.

Results:

Figure 16. Paddock 44 High EM Zone

Figure 17. Paddock 46 Medium EM Zone

Figure 18. Paddock 49 Low EM Zone

Observations and comments:
These paddocks have strong contrasts between the light and heavy soil and are therefore ideal for investigating differences.

The sensors are placed at 20cm, 40cm, 60cm, 80cm and 100cm in a plastic tube in the soil and a reading by each sensor is taken every 8 hours. On the graph the sensors are described by the software as 10cm, 20cm etc and so for interpretation of the lines double this value (this is an unfortunate software idiosyncrasy that I am sure will be fixed in time).

High or Heavy soil zone
Water use through the winter was mainly in the 20cm layer and the roots took water from 40cm and 60cm during October and early November when transpiration of water from the leaves was taking place as it became warmer and grain fill was occurring. There seemed to be little root development below the 60cm level, demonstrated by the flat lines on the graph (percentage of water) which remain stable because the plant roots are not using the water at this depth.

Medium soil zone
The main water use was down to 60cm. The deepest water use took place in October. The actual infiltration of soil water was deeper showing changes in moisture content down to 60cm with heavy rainfall.

Light soil zone
Water was extracted from all of the 20cm, 40cm and 60cm layers but there was some water use evident at the 80cm layer in October. The fluctuations at 100cm possibly indicate some drainage.

The water use down to 60cm took place about a month earlier as the water holding capacity of the soil is lower and the roots needed to find water at a deeper level.

From the yield map of the 2005 barley crop at Grand View in the previous paper, it is evident that at the paddock rate of N, the difference in yield between the zones was only around 0.5 t/ha. The deep nitrogen tests were even across the zones. This begs the question why didn't the heavier soil type which had ample water stored give more yield as there was water to depth that was not accessed by the roots? It is possible that the old saying "the answer lies in the soil" is very true but perhaps it should be "the answer lies in the sub soil!" It is possible that so much of the rain fell when the crop was close to finishing and that a crop that did not finish as early as barley would have shown higher yield differences in the zones.

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Riverine Plains Inc.

Barley Maximum Yield Experiment

Author: John Sykes

Contact No: 02 6023 1666

Company: John Sykes Rural Consulting, Albury

Location: Balldale
Growing Season Rainfall:
Annual: 505 mm
GSR: 342 mm
Soil:
Type: Red Brown Earth
pH (H_20): 4.8
P (Colwell): 32 mg/kg
Deep Soil N: 84 kg/ha
Sowing Information:
Sowing date: 18/6/2005
Fertiliser: 110 kg/ha MAP
Row Spacing: 180 mm
Paddock History:
2005 – Mixed Crop
2004 – Wheat
2003 – Canola
Plot Size: 1.5 x16
Replicates: 4

Key messages:

- Barley requires the same amount of nitrogen input as wheat to yield near its potential.
- 80-92 kg/ha of Nitrogen (N) is required to maximise yield.
- Barley responds strongly to extra N when fungicide is used to control disease.
- A preliminary program for growing barley is ready for farmers. Anyone interested should contact John Sykes.

Aim:
To assess the level of input required to maximise the yields of barley grown after wheat.

Method:
A replicated experiment was established using differing levels of post emergent N and fungicide to assess yield.

Results:

Table 4: Summary of Yield (t/ha), Protein (%), Screening and Retention (%) and Gross Margin ($/ha over Zero N) Results

Treatment Description	Yield (t/ha)	Screenings (%)	Protein (%)	Retention (%)	Gross Margin ($/ha)
Nil 0 N	2.8	2.2	9.1	67.3	$0
Nil 20 N[1]	3.4	1.5	8.7	69.8	$66
Nil 40 N	3.7	1.2	10.2	71.3	$79
Nil 80 N	4.2	1.8	11.4	68.8	$115
Nil 120 N	4.3	4.7	12.9	62.3	$86
SD[2], Fung Z31 + Z39[3], 0 N	3.3	1.2	8.7	71.0	$61
SD Fung Z31 + Z39, 20 N	3.8	1.5	9.6	71.8	$112
SD, Fung Z31+ Z39, 40 N	4.6	1.2	10.5	72.5	$164
SD, Fung Z31+ Z39, 80 N	5.6	1.1	11.1	73.0	$302
SD, Fung Z31+ Z39, 120 N	4.8	3.9	12.7	63.8	$147
SD, Fung Z31, 40 N	4.0	1.2	10.5	70.0	$120
SD, Fung Z39, 40 N	3.9	1.5	10.5	68.5	$102
SD, Fung Z45[4], 40 N	3.9	1.5	10.5	67.8	$112
SD, Fung Z31, 80 N	5.3	1.4	11.2	70.3	$263
SD, Z39 80 N	4.4	1.2	11.9	71.5	$140
SD, Z45 80 N	4.1	1.9	11.0	66.5	$88

1- Rate of post emergent N applied at Z15. 2 – SD – Seed Dressing as 1.5 L/t of Baytan. 3 – Fungicide as two applications of 500 ml/ha of 125 g/L Triadimefon at growth stages Z30 and Z39. 4- One application of 1 L/ha of 125 g/L Triadimefon fungicide at Z30, Z39 or Z45. Gross Margin – Over the Nil Zero N treatment. **Yield LSD (5%) – 0.24 t/ha**.

Observations and comments:

- Addition of N increased the yield with the optimum rate being 80 k/ha of N.
- Addition of fungicide increased yield by 17-30%. The highest response to fungicide came after the application of 80 kg/ha of N.
- The addition of the optimum rate of N and fungicide decreased the screenings of barley and increased the retention of barley.
- Two applications of fungicide at about Z31 and Z39 were better than a single application.
- Using 80 kg/ha of N and two sprays of fungicide gave the highest gross margin.

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Triticale Maximum Yield Experiment

Author: John Sykes

Contact No: 02 6023 1666

Organisation: John Sykes Rural Consulting, Albury

Location: Balldale
Growing Season Rainfall:
Annual: 505 mm
GSR: 342 mm
Soil:
Type: Red Brown Earth
pH (H_20): 4.8
P (Colwell): 32 mg/kg
Deep Soil N: 84 kg/ha
Sowing Information:
Sowing date: 18/6/2005
Fertiliser: 110 kg/ha MAP
Row Spacing: 180 mm
Paddock History:
2005 – Mixed Crop/triticale
2004 – Wheat
2003 – Canola
Plot Size: 1.5 x 16
Replicates: 4

Key messages:

- Triticale requires 80 kg/ha of N to maximise yield.
- Triticale requires the same amount of nitrogen input as wheat to yield near its potential.
- Kosciusko Triticale responds to the use of fungicide.

Aim:
To assess the level of input required to maximise the yields of triticale grown after wheat.

Method:
A replicated experiment was established using differing levels of post emergent N and fungicide to assess yield.

Results:

Table 5: Summary of Yield (t/ha), Protein (%) and Screening (%) and Gross Margin ($/ha over Zero N) Results

Treatment Description	Yield (t/ha)	Protein (%)	Gross Margin ($/ha)
0 N – Control	3.3	9.4	$0
20 N[1]	4.1	11.7	$68
40 N	5.3	10.5	$188
80 N	5.5	11.0	$172
120 N	4.9	10.3	$69
Fungicide[2] 0 N	4.1	9.4	$77
Fungicide 20 N	5.3	10.0	$198
Fungicide 40 N	5.6	11.3	$175
Fungicide 80 N	6.2	11.1	$245
Fungicide 120 N	6.2	11.1	$203

1- Rate of post emergent N applied at Z15. 2 – Two applications of 1 L/ha of 125 g/L Triadimefon fungicide at Z30 and Z39.
Yield LSD (5%) – 0.27 t/ha.

Observations and comments:

- Addition of N significantly increased the yield with the optimum rate being 80 kg/ha of N.
- Addition of fungicide increased yield by about 15%. This was the second year that this result was achieved.
- The most economic treatment (gross margin) was 80 kg/ha of N and two fungicide applications at Z31 and Z39.

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Wheat Maximum Yield Experiment

Author: John Sykes

Contact No: 02 6023 1666

Organisation: John Sykes Rural Consulting, Albury

Location: Balldale
Growing Season Rainfall:
Annual: 505 mm
GSR: 342 mm
Soil:
Type: Red Brown Earth
pH ($H_2$0): 4.8
P (Colwell): 32 mg/kg
Deep Soil N: 84 kg/ha
Sowing Information:
Sowing date: 18/6/2005
Fertiliser: 110 kg/ha MAP
Row Spacing: 180 mm
Paddock History:
2005 – Mixed Crop
2004 – Wheat
2003 – Canola
Plot Size: 1.5 x16
Replicates: 4

Key messages:

- Wheat on wheat uses high inputs.
- Wheat requires a high amount of nitrogen input to yield near its potential in a good year.

Aim:
To assess the level of input required to maximise the yields of wheat grown after wheat.

Method:
A replicated experiment was established using different levels of post emergent N and fungicide to assess yield.

Results:

Table 6: Summary of Yield (t/ha), Protein (%) and Screening (%) and Gross Margin ($/ha over Zero N) Results

Treatment Description	Yield (t/ha)	Protein (%)	Screenings (%)	Gross Margin ($/ha)
0 N	2.9	9.1	6.8	$0
20 N	3.0	9.0	5.9	-$2
40 N	3.9	10.8	6.7	$101
80 N	4.5	11.7	6.0	$143
120 N	4.5	14.1	7.5	$96
Fungicide Z31 & Z39[1], N	3.2	9.4	1.4	$32
Fungicide Z31 & Z39, 20 N	4.0	9.4	1.4	$124
Fungicide Z31 & Z39, 40 N	4.5	10.4	1.4	$164
Fungicide Z31 & Z39, 80 N	5.2	11.3	1.1	$280
Fungicide Z31 & Z39, 120 N	5.4	13.8	1.3	$201
Fungicide[2] Z31, 80N	4.9	11.4	1.4	$196
Fungicide Z39, 80N	4.6	10.9	1.5	$149
Fungicide Z45, 80N	3.7	11.4	3.5	$24

1 – Fungicide Z31 & Z39 - Two applications of 1 L/ha of 125 g/L Triadimefon at growth stages Z30 and Z39.
2 – One application of 1 L/ha of 125 g/L Triadimefon fungicide at either Z30, Z39 or Z45.
All seed treated with Jockey seed dressing. **Yield LSD (5%) – 0.32 t/ha**.

Observations and comments:

- Addition of N increased the yield. The optimum rate was 80 kg/ha of N.
- Addition of fungicide increased yield by 0.3-1.0 t/ha (10-15%) over similar N treatments.
- A single application of fungicide at Z30-Z33 was as good as two applications of fungicide.
- The most economic treatments (Highest Gross Margins) were 80 kg/ha of N with 2 sprays of Triadimefon.

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Wheat Fungicide Timing Experiment

Author: John Sykes

Contact No: 02 6023 1666

Organisation: John Sykes Rural Consulting, Albury

Location: Balldale
Growing Season Rainfall:
Annual: 505 mm
GSR: 342 mm
Soil:
Type: Red Brown Earth
pH (H_20): 4.8
P (Colwell): 32 mg/kg
Deep Soil N: 84 kg/ha
Sowing Information:
Sowing date: 18/6/2005
Fertiliser: 110 kg/ha MAP
Row Spacing: 180 mm
Paddock History:
2005 – Mixed Crop
2004 – Wheat
2003 – Canola
Plot Size: 1.5 x 16
Replicates: 4

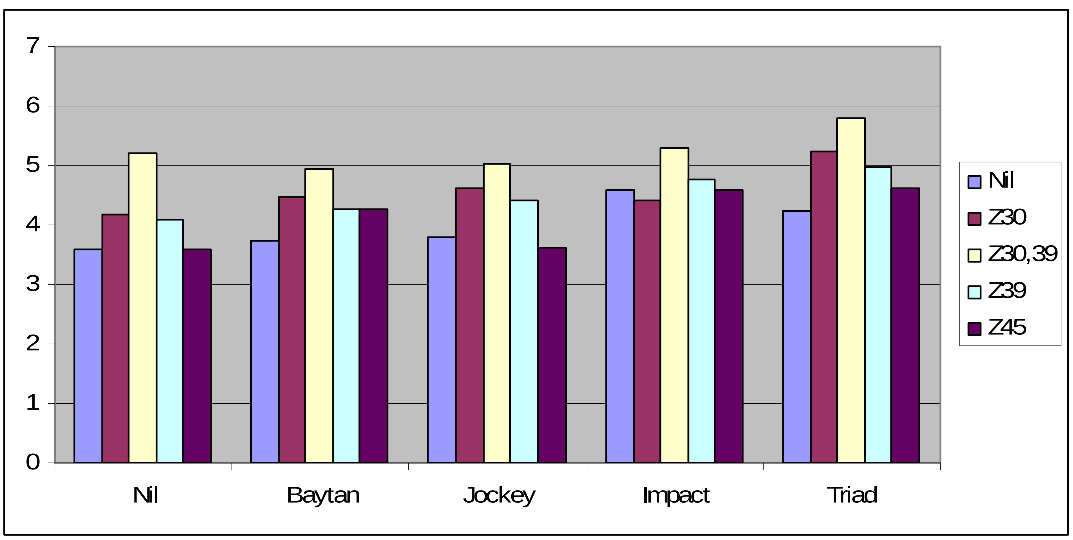
Key messages:

- Fungicides are an effective way of controlling Stripe Rust in wheat.
- The best control of Stripe Rust and the highest yield response came from 2 sprays with Triadimefon at Z32 and Z39.
- Impact® fertilizer dressing and Triad® fertilizer powder gave early control of Stripe Rust but were not satisfactory for season long protection.
- Baytan® and Jockey® seed dressings were not as effective as Impact.

Aim:
To assess different fungicide timings and dressings for Stripe Rust control and yield responses.

Method:
A replicated experiment was established comparing different timings of Triadimefon fungicide and seed or fertilizer dressings for their ability to control Stripe Rust.

Results:



Z – Zadok's growth stage. Baytan – Baytan® seed dressing at 1.5 L/t. Jockey – Jockey® seed dressing at 1.5 L/t. Impact® – Impact applied to fertilizer. Triad – 4Farmers 450 g/kg Triadimefon (Triad) fungicide powder applied at 210 gm/t to fertilizer. Z30 -An application of 1 l/ha of Triad at growth stage Z30-33. Z30,39 - Two applications of 1 l/ha of Triad at growth stage Z30 and Z39. Z39 - An application of 1 l/ha of Triad at growth stage Z39. Z45 - An application of 1 l/ha of Triad at growth stage Z45.
LSD 0.45 t/ha

Figure 19. Summary of Yield (t/ha), Protein (%), Screening and Retention (%) and Gross Margin ($/ha over Zero N) Results

Observations and comments:

- Control of stripe rust resulted in a 30% improvement in yield.
- Best yields were achieved from 2 sprays of fungicide at Z30 and Z39.
- There was a significant improvement in yield from the use of the fertilizer treatments Impact and Triad. These treatments with one spray were not significantly different from 2 sprays with Triadimefon.
- Application at growth stage Z30 was the best single timing but was not significantly different from Z39 where a seed treatment had been used.
- The relatively poor response to Impact was not expected but may be due to the high level of disease pressure or the timing of infection.
- Protein levels were not significantly affected by the fungicide application.
- Screenings increased in the non treated or non sprayed plots. Most sprayed plots had screenings of 1-2%. The untreated (Nil) plot had an average screenings of 4.4% and the late application (Z45) had screenings of 2.5%.

Sponsors:

The Grains Research & Development Corporation, Mr R Mathews, Mr R McDonald.

Wheat Fungicide Product Comparison

Author: John Sykes

Contact No: 02 6023 1666

Organisation: John Sykes Rural Consulting, Albury

Location: Yarrawonga
Growing Season Rainfall:
Annual: 451 mm
GSR: 323 mm
Soil:
Type: Clay Vertosol
pH (H_20):
P (Colwell): 52 mg/kg
Sowing Information:
Sowing date: 25/4/2005
Fertiliser: 90 kg/ha MAP
Row Spacing: 227 mm
Paddock History:
2005 – Wheat
Plot Size: 1.5 ha
Replicates: 2 (paired plots)

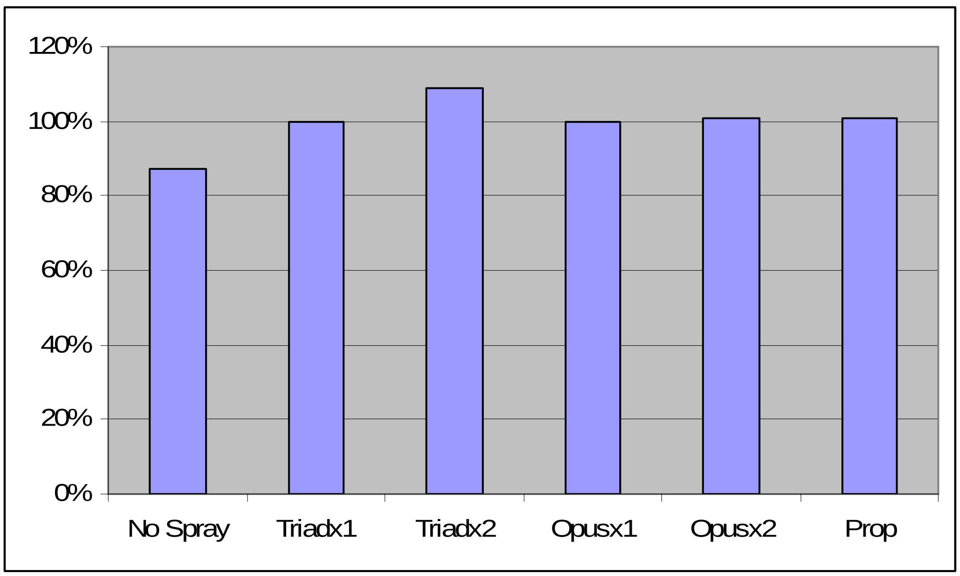
Key messages:

- Using Triadimefon is as good as using other fungicides.
- Triadimefon is the most cost effective product.

Aim:
To compare the performances of different products for the control of Stripe Rust.

Method:
A large area paired plot, with replicated standard plot, experiment was established comparing different products and timings of Whistler wheat. Results are expressed as a percentage of the yield of the nearest standard treatment (Triad x 1).

Results:



No Spray – Nil treatment with fungicide. All plots otherwise treated with normal management. Triad x 1 – Triadimefon @ 500 ml/ha applied at Z33 (standard treatment with adjusted yield of 4.6 t/ha shown as 100%). Triad x 2 - Triadimefon @ 500 ml/ha applied at Z33 and Z39. Opus x 1 – Opus® @ 500 ml/ha applied at Z33. Opus x 2 – Opus @ 500 ml/ha at Z39. Prop – Propiconazole @ 250 ml/ha applied at Z33. Results significant at 0.05 using t-test analysis of paired yield points. Wheat variety – Whistler @ 80 kg/ha.

Figure 20. Yields (as a % of Triad x 1 treatment) of Wheat Treated with Various Fungicide Products

Observations and comments:

- Spraying resulted in a 13% improvement in yield. This was a statistically significant result.
- A single application of Triadimefon fungicide at Z33 was as good as all the other treatments. While 2 sprays with Triadimefon gave the higher yield than a single spray it was not significantly different to a single spray.
- None of the products gave a significantly different yield to the standard. Application of the new fungicide Opus® did not result in a better yield than using Propiconazole or Triadimefon.
- Disease assessment and scoring throughout the growing season showed that Opus kept the plants greener with lower Stripe Rust damage scores than the other products.
- The results confirm that using the least cost product, Triadimefon, was as good as using the more expensive options like Propiconazole and Opus.

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Riverine Plains Inc.

Crop Comparison after Wheat and Canola

Author: John Sykes

Contact No: 02 6023 1666

Organisation: John Sykes Rural Consulting, Albury

Location: Balldale
Growing Season Rainfall:
Annual: 505 mm
GSR: 342 mm
Soil:
Type: Red Brown Earth
pH (H_2O): 4.8
P (Colwell): 32 mg/kg
Deep Soil N: 84 kg/ha
Sowing Information:
Sowing date: 18/6/2005
Fertiliser: 110 kg/ha MAP
Row Spacing: 180 mm
Paddock History:
2005 – Mixed Crop
2004 – Wheat
2003 – Canola
Plot Size: 1.5 x 16
Replicates: 4

Key messages:

- Wheat on wheat following canola is an alternative that will enable more cereal crop to be grown in a rotation.
- Raising inputs on cereals to increase yield returns well in $/ha.
- Alternative crops such as canola and lupins are not high income earners compared to growing cereals with optimum (higher than average) inputs.

Aim:
To test if wheat can be successfully grown after wheat and canola and to assess if wheat was the best crop to grow.

Method:
A replicated experiment was established using similar treatments to 2004.
However, to test the alternative crops, canola and lupins were added to the experiment.

Results:

Table 7: Yield (t/ha) and return (Gross Margin or GM in $/ha over farmer[1] wheat) of the 2005 Crop Comparison Experiment

	Farmer[1]		Hi N[2]		Hi N+Fungicide[3]	
	Yield	GM	Yield	GM	Yield	GM
Wheat	3.3	$0.00	4.8	$168.86	5.6	$263.36
Triticale	3.5	-$4.09	5.6	$213.59	6.1	$255.21
Barley	2.8	-$42.38	3.7	$48.47	4.9	$190.21
Canola	1.4	-$88.56	2.1	$128.85		
Lupins	1.4	-$70.95				

1- Normal Farm management. P applied at 23 kg/ha, N at 53 kg/ha including 40 kg/ha post emergent. 2- Management as for farmers but 80 kg/ha of N applied post emergent. 3 – As for 2 plus 2 x 1 l/ha applications of 125 g/L Triadimefon fungicide applied at Z32 and Z39 for disease control. **Yield LSD (5%) – 0.38 t/ha**.

Table 8: Summary of Protein (%) and Screening and Retention Results of the 2005 Crop Comparison Experiment - Riverine Plains Third Crop Program

Crop	Farmer[1]		Hi N[1]		Hi N+Fungicide[1]	
	Protein	Scrn/Ret[2]	Protein	Scrn/Ret	Protein	Scrn/Ret
Diamondbird Wheat	11.2%	2.3%	13.1%	6.7%	12.2%	0.6%
Kosciusko Triticale	10.8%		13.8%		12.4%	
Gairdner Barley	10.5%	67.5%	12.9%	68%	11.8%	68.5%
Grace Canola	32.1%		29.8%			
Wonga Lupins	28.4%					

1- See descriptions in Table 7. 2-Scrn/Ret – Screenings for wheat and retention for barley.

Observations and comments:

- Addition of N and the use of fungicide significantly increased the yield of all cereals. This is similar to the 2004 result.
- Addition of N increased the protein of wheat, triticale and barley.
- Addition of fungicide resulted in a small decrease in the protein level in wheat.
- Addition of N and fungicide decreased the screenings in wheat and increased the retention of barley. This was desirable.
- Quality results are similar to the 2004 results except for barley which is contrary to the 2004 results.

Sponsors:
The Grains Research & Development Corporation, Mr R Mathews, Mr R McDonald.

INSERT GRAIN GROWERS ASSOCIATION AD

State Focus Trial – Katamatite – SeedN and FeedN

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Katamatite
Growing Season Rainfall:
GSR: (Apr-Oct) 330 mm
Soil:
pH (H_20): 5.5 (0-10cm)
Sowing Information:
Sowing date: 17/6/2005
Fertiliser: 100 kg MAP/ha
Row Spacing: 18 cm
Paddock History:
2005 – Wheat
2004 – Canola
2003 – Wheat
Plot Size: 4.8 m x 100m
Replicates: nil

Key messages:
- There was no advantage to increasing plant density above standard rates when sown in the middle of June at Katamatite.
- An up front N application of 40 kg/ha yielded the same as the same amount spread in September.

Aim:
To investigate how changing sowing rates and nitrogen management impacted yield and quality in a June sown crop at Katamatite.

Method:
Bowerbird wheat was sown into plots measuring 4.8m x 100m using the growers' combine. The paddock had a background nitrogen (N) level of 130 kg/ha (mineralisation + soil N). Seed was sown at low (45 kg/ha) or a normal (75 kg/ha) rate and each was further divided into one of the following nitrogen treatments: nil nitrogen, up front N, or N as required. The upfront + N treatment received 40 kg N/ha added as urea at sowing, while the N as needed treatment had 40 kg N/ha top dressed on the 30th September 2005. The N treated crops had enough N to achieve 4.1 t/ha, while the untreated crops had enough N to achieve 3 t/ha. Plots were also treated with an Epoxiconazole fungicide on the 18th August 2005 and 6th October 2005 to control stripe rust. Plots were harvested on the 26th December 2005.

Results:

Table 9: The response of Bowerbird at different sowing rates to additional N applications

Seeding rate	Normal Seeding	Low Seeding	Low Seeding	Normal Seeding	Normal Seeding	Normal Seeding	Normal Seeding
Nitrogen	**Nil N (control)**	**Nil N**	**N Upfront**	**Nil N (control)**	**N Upfront**	**N as needed**	**Nil N (Control)**
Plants/ m^2	276	168	191	304	245	295	260
Heads/m^2	348	320	352	397	407	370	360
Protein %	9.0	9.3	9.3	9.2	9.6	9.0	9.1
Screenings%	1.6	2.2	1.8	2.3	2.1	2.3	2.8
N Uptake	57.6	56.7	63.4	55.5	65.9	62.1	54.6
Yield t/ha	4.00	3.81	4.26	3.77	4.29	4.31	3.75
				CV yield%	**3.4**		
				LSD yield	**0.69**		

Observations and comments:
There was no significant difference in yield between the normal and low seeding rates when plots were compared within each N treatment (+ or – N). Seed analysis done after sowing indicated that the retained seed from the 2004 season was much smaller (pinched and shrivelled) than anticipated so that establishment rates were much higher than expected for these sowing rates.

When the N treatment plots were compared, there was a difference between the + N (either upfront or as required) and the nil N treatments at both seeding rates, although this difference was not significant for either sowing rate. As in the Miepoll State Focus, up front urea increased the number of heads/m^2, which contributed to increased yield. Protein was lower than expected for all treatments, which may indicate that N was limiting and that N was utilised for yield in preference to protein. Unlike Miepoll, up front N did not consistently increase protein in this trial and screenings remained low in all treatments.

The nil nitrogen plots yielded higher than expected possibly due to greater mineralisation (80 kg N/ha instead of 50) or root growth below the 60cm soil test depth, accessing deeper soil N.

Sponsors:
Farmer Co-Operator: Pendlebury family, Katamatite, Victoria.

State Focus Trial - Miepoll

Authors: Michelle Pardy and Dale Grey

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Miepoll
Growing Season Rainfall:
GSR: (Apr-Oct) 494 mm
Soil:
Type: Grey Clay Loam
pH (H_20): 5.7 (0-10cm)
Sowing Information:
Sowing date: 7/8/2005
Fertiliser: 110 kg DAP/ha
Paddock History:
2005 – Wheat
2004 – Canola
2003 – Triticale
Plot Size: 6m x 118m
Replicates: 3

Key messages:
- A normal district sowing rate of ~80 kg/ha produced the best yield results for a late season (August) sowing at Miepoll.
- An upfront N application of urea at sowing boosted head numbers, yield and protein compared to the nil N treatment.

Aim:
To investigate how changing sowing rates and nitrogen management impacted yield and quality in an August sown crop in the high rainfall zone.

Method:
Chara wheat was sown onto raised bed plots measuring 6m x 118m using the grower's air seeder. The paddock had a background nitrogen (N) level in the soil of 180 kg/ha (mineralisation + soil N) and had 110 kg/ha DAP applied as starter fertiliser at sowing. Seed was sown at low (40 kg/ha), medium (82 kg/ha) and high (120 kg/ha) rates and each was further divided into either a nil nitrogen treatment or an up front N treatment. The + N treatment received an additional 40 kg/ha N added as urea at sowing. The N treated crops had enough N to achieve 6 t/ha, while the untreated crops had enough N to achieve 5 t/ha. Fertiliser was treated with a flutriafol fungicide (Impact in furrow) to prevent stripe rust. Plots were also treated with an Epoxiconazole fungicide to control stripe rust on the 18th October 2005. Plots were harvested on the 6th January 2006.

Results:

Table 10: The response of Chara at different sowing rates to additional application of N

Seeding rate	High Seeding	High Seeding	Normal Seeding	Normal Seeding	Low Seeding	Low Seeding
Nitrogen	**Nil N**	**N Upfront**	**Nil N (control)**	**N Upfront**	**Nil N**	**N Upfront**
Plants/m^2	224	222	175	169	95	104
Heads/m^2	396	515	383	422	399	456
Protein%	9.67	10.6	9.8	10.4	10.3	10.9
Screenings%	3.13	2.97	3	3.13	3.86	4.9
Yield t/ha	3.56	4.09	3.57	3.94	3.39	3.66
N Uptake	55	69	56	66	56	63
			CV% yield	**2.7**		
			LSD yield	**0.18**		

Observations and comments:
From the results, there was no significant difference between the high and normal sowing rates for either the - N or + N treatments, however the low seeding rate yielded significantly less than the other sowing rates. Given the late sowing (August), it is likely the plants in the low seeding rate tried to compensate for low plant numbers by producing late tillers, which failed to fill adequately, leading to comparatively high levels of screenings relative to the other treatments, as well as lower yields. In summary, a normal seeding rate appeared to provide the best results compared to a higher than normal, or lower than normal seeding rate at Miepoll during 2005. This result is different to the results of the fungicide trial (also at Miepoll) in which the higher seeding rate increased yield over the other treatments.

The other component in this trial was the application of 40 kg/ha N applied as upfront urea to half the plots. Despite the high levels of background N (180 kg/ha mineralisation + soil N), upfront urea increased yield in all seeding rate treatments, by between 210 kg and 500 kg/ha. The main effect of the up front N was to increase head numbers by between 30 (normal seeding) and 120 heads/m^2 (high seeding), which was the most likely main contributor to yield. Up front N also increased protein by between 0.6-1.0%. Screenings results were variable between the treatments, however the low seeding rates had the highest levels of screenings. Given the August planting and the favourable spring, it is likely that the up front N encouraged rapid early growth and tillering compared to the nil N trials. This increased head numbers and lifted yield.

Sponsors:
Farmer Co-Operators: Hunt family, Moglonemby, Victoria.

Variety Demonstration - Miepoll

Authors: Michelle Pardy and Dale Grey

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Miepoll
Growing Season Rainfall:
GSR: (Apr-Nov) 494 mm
Soil:
Type: Brown Loam
Sowing Information:
Sowing date: 8/8/05
Fertiliser: 100 kg/ha DAP
Row Spacing: 20 cm
Paddock History:
2005 – Wheat
2004 – Canola
2003 – Wheat
Plot Size: 7.7m x 100m
Replicates: nil

Key messages:

- An August sowing yielded 2.5-3.5 t/ha in a high rainfall environment in 2005.
- Sowing just prior to a large (~1 inch) rainfall event resulted in patchy germination due to burst seed in some plots.
- Long season wheats performed better than short season varieties at this site in 2005.

Aim:
To evaluate the performance of several wheat varieties against barley and oats, when sown late in a high rainfall environment.

Method:
Several varieties were sown in plots measuring 100m x 7.7m using the grower's airseeder. Seed was sown at a standard rate of 85 kg with 100 kg/ha DAP. A late break followed by an extended period of wet weather made paddocks untrafficable and caused sowing to be delayed until August.

Results:

Table 11: Plot yields ranked highest to lowest

Variety	Plants/m^2	Yield t/ha
Whistler Wheat	117	3.49
Possum Oats	91	3.47
Schooner Barley	72	3.35
Yitpi Wheat	104	3.29
Diamondbird Wheat	104	3.01
Chara Wheat (average 5 reps)	120	3.01
Ventura Wheat	82	2.64
Ruby Wheat	125	2.62
Drysdale Wheat	91	2.55

Observations and comments:
An inch of rain fell on the night of sowing. This caused some seed to burst, resulting in patchy germination in some plots. Stripe rust was noted at high levels in some plots on the 4th October 2005 at growth stage Z31 and the trial and surrounding crop was treated with a fungicide on 10th October 2005.

Of the wheat varieties, the longer season types performed considerably better than the shorter season varieties at this trial site. At this site, it is likely that these differences were a reflection of the August sowing and the relatively wet spring. The shorter season varieties such as Drysdale and Ruby were disadvantaged with tillering, flowering, and grain filling occurring in a much shorter timeframe than the longer season types. By contrast, mid-late maturing varieties such as Whistler, Yitpi, Diamondbird and Chara could better use resources available (nutrients and moisture) to increase yield over an extended period. The results also show that oats and barley were good options for late sowing in 2005.

Sponsors:
Farmer Co-Operators: Gough family, Miepoll, Victoria.

Fungicide Trial - Miepoll

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Miepoll
Growing Season Rainfall:
GSR: (Apr-Oct) 494 mm
Soil:
Type: Grey Clay Loam
pH (H_20): 5.7 (0-10cm)
Sowing Information:
Sowing date: 7/8/2005
Fertiliser: 110 kg DAP/ha
Paddock History:
2005 – Wheat
2004 – Canola
2003 – Triticale
Plot Size: 4.5m x 130m
Replicates: 3

Key message:
- An application of a foliar fungicide at flag leaf emergence did not increase yield when fertiliser was treated with a flutriafol fungicide (Impact in furrow).
- A high seeding rate yielded higher than a low seeding rate in this trial.
- Drysdale yielded more than Yitpi in this trial.

Aim:
To investigate the difference an in crop application of fungicide made to seed treated with a flutriafol fungicide to control stripe rust (impact in furrow) at different seeding rates.

Method:
Chara (Table 12) was sown in plots measuring 4.5m x 130m using the grower's air seeder. Seed was sown into moist soil at low (40 kg/ha), medium (82 kg/ha) and high (120 kg/ha) sowing rates with 110 kg/ha DAP fertiliser treated with a flutriafol fungicide. Plots were treated with an Epoxiconazole fungicide at Z39 to control stripe rust on the 18th October 2005. Plots were harvested on the 6th January 2006.

A second trial, which included the varieties Drysdale, Yitpi, and a blend of both, were treated with and without an application of foliar fungicide (Table 13). All sowing details are as above.

Results:

Table 12: The response of Chara at different sowing rates to a foliar application of fungicide

Seeding rate	Treatment	Protein %	Screenings %	Test Wt	Moisture %	Yield (t/ha)
Low	-fung	10.7	5.4	83	10.2	3.69
Low	+fung	10.1	5.3	82	9.9	3.60
Med	-fung	10.1	5.3	82	10.0	4.10
Med	+fung	10.1	4.0	84	10.4	3.76
High	-fung	10.0	3.5	81	10.3	4.30
High	+fung	10.4	4.0	82	11.5	4.38

Table 13: The response of Drysdale, Yitpi and a blend of these varieties to a foliar application of fungicide

Variety	Treatment	Yield (t/ha)	Variety	Treatment	Yield (t/ha)	Variety	Treatment	Yield (t/ha)
Drysdale	-fung	3.55	Yitpi	-fung	3.02	blend	-fung	3.23
Drysdale	+fung	3.58	Yitpi	+fung	3.02	blend	+fung	3.15

Observations and comments:
There was very little difference in yield between the + and – fungicide treatments for each of the seeding rates. The lack of response to the foliar fungicide could have been due to the application of a flutriafol fungicide (in furrow) at sowing. Due to the late sowing this fungicide could have remained effective against stripe rust from August, until October when temperatures increased enough to slow the cycling of the stripe rust fungus.

As a result, this became a sowing rate trial. The low seeding rate yielded less than the medium seeding rate, which yielded less than the high seeding rate trial. Taking into consideration the late start (crop sown 7th August 2005), which reduced the time available for tillering, the higher seeding rate would have produced more heads/m^2 and hence a greater yield potential compared to the other treatments.

In a separate trial, the varieties Drysdale, Yitpi, and a blend of both, were treated with and without fungicide to observe any varietal differences. While there was virtually no difference between the treatments, there was a varietal response, with Drysdale out yielding Yitpi and the blend yielding mid way between the two varieties. Again, fertiliser was treated with a flutriafol fungicide at sowing, which reduced stripe rust spore build-up.

Another trial sown to Drysdale in mid June on the same property showed the same trend. The foliar fungicide did not have an effect where an in-furrow treatment was used, which is to be expected in some seasons and situations by delaying the onset of the disease (data not presented).

Sponsors:
Farmer Co-Operator: Don Hunt, Miepoll, Victoria.

Variety Demonstration - Picola

Authors: Michelle Pardy and Dale Grey

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Picola
Growing Season Rainfall:
GSR: (Apr-Oct) 292 mm
Soil:
Type: Self Mulching Grey Clay
pH ($H_2$0): 5.8 (0-10cm)
Sowing Information:
Sowing date: 15/6/05
Fertiliser: MAP + Cu + Zn (sowing) + 60L/ha UAN (22/8/05)
Row Spacing: 27 cm
Paddock History:
2005 – Wheat
2004 – Canola
2003 – Barley
Plot Size: 100m x 9.1 m
Replicates: nil

Key message:

- Diamondbird, Ventura and Chara were the highest yielding varieties at Picola during the 2005 season.

Aim:
To evaluate the performance of several wheat varieties sown in mid June in a low rainfall environment.

Method:
Several varieties were sown in plots measuring 100m x 9.1m using the grower's air seeder. Seed was sown at 85 kg/ha with 100 kg/ha MAP into moist soil. Plots were treated with an Epoxiconazole fungicide to control stripe rust on the 2nd September 2005. Plots were harvested on the 16th December 2005.

Results:

Table 14: Variety yields ranked highest to lowest

Variety	Protein %	Screenings %	Yield (t/ha)
Drysdale	9.6	1.4	5.59
Diamondbird	9.0	0.7	4.83
Ventura	9.4	1.0	4.28
Chara (average 5 plots)	9.1	2.2	3.82
Whistler	9.4	1.3	3.64
Yitpi	9.7	1.4	3.39
Pugsley	9.1	0.6	3.09
Ruby	8.6	0.8	2.86
Shenton	9.6	1.0	2.46
H45	9.7	5.2	2.14
LSD ($p<0.05$)			1.58
CV%			14.2%

Observations and comments:
Diamondbird, Whistler and Chara, which were all top 3 finishers in 2004, continued to perform, with the 2005 results ranking them all in the top 4. The result for Drysdale, which topped the trial in 2005, is misleading as the plot was partly oversown by Chara. In this case an increased plant density probably led to an increase in head numbers/m^2, which consequently increased yield. This was the first year Ventura was included in these trials, and its performance was encouraging. Protein and screenings results were generally low, which was a reflection of the cool, wet finish which encouraged yield at the expense of protein. H45 was badly affected by stripe rust early in the season and showed high screenings.

Sponsors:
Farmer Co-Operators: Gilby family, Kotupna, Victoria.

Stubble Retention Canola Demonstration- Boorhaman

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Boorhaman
Growing Season Rainfall:
GSR: (Apr-Nov) 370 mm
Soil:
Type: Red Loam
Sowing Information:
Sowing date: 26/5/05
Fertiliser: 100 kg/ha DAP
Row Spacing: 20 cm
Paddock History:
2005 – Canola
2004 – Wheat
2003 – Triticale
Plot Size: 8m x 100m
Replicates: nil

Key message:

- Seed placement with no stubble coverage is critical for getting canola plants up with good early vigour.
- Burning decreased grass weed competition.
- Low plant counts in canola can still yield well.

Aim:
To evaluate canola growth and yield under various stubble retention methods.

Method:
A Diamondbird wheat paddock that yielded 5 t/ha in 2004 had its stubble grazed and either mulched to 7 cm height, disced in, burnt or retained as is. Grace canola was dry sown at 4 kg/ha into the treatments in late May. Plant counts were undertaken on the 2nd September 2005 and the plots were windrowed, harvested and weighed with a weigh bin.

Results:

Table 15: Yield for various stubble management treatments

	Establishment (plants/m^2)	Yield (t/ha)
Mulched	15.8	2.17
Retained	10.7	2.25
Cultivated	12.2	2.42
Burnt	15.9	2.75

Observations and comments:
Overall plant establishment was low in all treatments. There was visibly poorer establishment and vigour where the stubble was retained and especially where stubble covered the seed row. Other research into stubble retention has shown delayed establishment due to lower soil temperatures (J.Kirkegaard, pers. comm.). Grass weed germination was highest in the cultivated treatment and lowest in the burnt area, the stubble retained plots were intermediate. Highest yield was achieved in the burnt and cultivated treatments. Nitrogen tie up by the stubble may have contributed to lower yield in the stubble retained areas, although CSIRO research showed that the loss of vigour in stubble retained canola crops was often not compensated for with equivalent yield later in the season, irrespective of nitrogen management.

Sponsors:
Farmer Co-Operators: O'Keefe family, Boorhaman, Victoria.

Deep Soil N Testing Paddock Performance Results

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Key messages:

- Nitrogen uptake efficiency in monitored crops was generally poor this year, varying from 26-62% and averaging 38%.
- Paddocks with known agronomic constraints had the worst nitrogen use efficiencies.

Aim:
To evaluate the performance of paddocks that were deep soil N tested before sowing.

Method:
Prior to the season break, various paddocks were soil tested to a depth of 60 cm in 0-10 and 10-60 cm intervals. These soil cores were tested for available nitrate and ammonium to give a total available nitrogen content in kg/ha. The yield and protein results were obtained from the farmer.

Results:

Table 16: Details of paddocks tested

Location	Status	Rotation	Variety	Paddock preparation	Sowing date
Congupna 2	Irrigated	W/W		Stubble ret	Unsown
Congupna 3	Irrigated	Maize		Maize stubble	Unsown
Congupna 1	Irrigated	W/Faba/W	Wintaroo hay	Bare	30-Jul-05
Katamatite 1	Irrigated	Sub/W/Triticale	Muir Triticale	Burnt	16-Jun-05
Katamatite 2	Irrigated	B/C/W	Whistler wheat	Canola stubble	25-May-05
Picola 3	Irrigated	C/W/Persian	Yitpi wheat	Pasture residue	14-Jun-05
Picola 1	Dryland	B/C/W	Chara wheat	Bare	15-Jun-05
Picola 2	Dryland	C/Bar	Gairdner Barley	Cultivated	16-Jun-05
Picola 4	Dryland	Fallow/W	Frame wheat	Cultivated	5-Jun-05
Katamatite 3	Dryland	B/W	Bowerbird	Heliotrope	27-Jun-05
Katamatite 4	Dryland	C/W	Bowerbird	Stubble	17-Jun-05
Boorhaman 1	Dryland	C/W	Diamondbird	Canola stubble	29-May-05
Boorhaman 2	Dryland	Past/W	Diamondbird	Pasture	17-Jun-05
Boorhaman 3	Dryland	Past/W	Diamondbird	Grazed - bare	15-Jun-05
Devenish	Dryland	C/W	Diamondbird	Stubble - grazed	15-May-05
St James	Dryland	W/W	Whistler wheat	Burnt stubble	16-Jun-05
Euroa	Dryland	W/W/T/T/C/W	Chara wheat	Grazed Bare	7-Aug-05

The two paddocks tested as Congupna 2 and 3 became too wet after the break and were not sown, being instead fallowed in preparation for a summer crop. The soil test taken after the maize crop (Congupna 3) indicated the nitrogen status was very low.

Table 17: Nitrogen balance of paddocks tested

Location	Variety	Avail N (kg/ha)	Topdressed (kg N/ha)	Date Topdressed	Grain yield (t/ha)	Grain protein (%)	Grain N uptake* (kg/ha)	Total N avail# (kg/ha)	N uptake Effic. ## (%)
Congupna 2	N/a	114		saved for summer crop					
Congupna 3	N/a	36		saved for summer crop					
Congupna 1	Wintaroo hay	101	12+37	11th Sept	7.70	hay		200	
Katamatite 1	Muir Triticale	69	10	Sowing	4.00	NA		129	
Katamatite 2	Whistler wheat	96	10+46	2nd Aug	4.80	10.2	78	202	39
Picola 3	Yitpi wheat	99	10	Sowing	4.00	10.0	64	159	40
Picola 1	Chara wheat	96	8+26	22nd Aug	3.82	9.4	57	180	32
Picola 2	Gairdner Barley	45	8+37	12th Sep	3.20	11.4	58	140	42
Picola 4	Frame wheat	140	8	Sowing	3.75	NA		198	
Katamatite 3	Bowerbird	66	10+32	30th Aug	3.00	8.8	42	158	27
Katamatite 4	Bowerbird	86	10+41	30th Sept	3.70	9.1	54	187	29
Boorhaman 1	Diamondbird	107	10+ 35	28th Sep	3.40	9.8	53	202	26
Boorhaman 2	Diamondbird	86	8	Sowing	2.57	12.5	51	144	36
Boorhaman 3	Diamondbird	61	10+35	30th Aug	5.00	12.1	97	156	62
Devenish	Diamondbird	102	37+37	12th Aug+ 4th Oct	5.20	13.5	112	226	50
St James	Whistler wheat	153	10+23	3rd Sept	4.50	11.0	79	236	34
Euroa	Chara wheat	116	10	Sowing	3.25	9.8	51	176	29

*Grain N uptake kg/ha = (Protein result / 6.25 x yield)/100
[#] Total N available includes soil N at sowing, fertiliser N applied and 50 kg/ha of mineralised N.
[##]N uptake efficiency = Grain N uptake/Total N available in soil.

Observations and Comments:
Very few paddocks had good nitrogen uptake efficiency ratios this year. N uptake efficiencies are calculated by comparing the amount of N uptake in the grain versus the amount of N available to the crop. It is unclear whether the low uptakes were caused by denitrification during the wet winter, or as a result of nitrogen leaching during the wet spring. Some paddocks had N uptake efficiencies lower than 30%, indicating that something other than N was the limiting factor. The paddock, Katamatite 3, was full of heliotrope over summer and had no subsoil moisture and Katamatite 4 developed high levels of stripe rust prior to grain fill. It is not known what occurred at Boorhaman 1, however frost remains a possible cause for the yield failure of an otherwise promising crop. Euroa was sown late in the middle of August and responded a small amount to added N (see Miepoll state focus) but was constrained by the late sowing date. Two paddocks Boorhaman 3 and Devenish had higher efficiency ratios, which more closely matched the targeted standard of 50% N uptake efficiency. Boorhaman 3 followed a very good sub-clover pasture, however the available N result of 61 N kg/ha was lower than expected given its history. It is possible that mineralisation was higher than the assumed 50 kg N/ha in this paddock, however this would make the efficiency lower than 62%. Devenish yielded very well and had a very high protein content, possibly due to the late application of N.

Sponsors:
Farmer Co-Operators, various NE TOPCROP group members.

The Wheat Leaf Pulling Trials 2005

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Key messages:

- Following flag leaf emergence (Z39) in wheat, between 56-72% of yield was derived from the head and stem in crops yielding >3t/ha.
- In crops yielding <3t/ha, the head and stem contributed between 88-100% of yield.

Aim:

To determine the relative contribution of wheat leaves to yield under Australian conditions.

Method:

DPI CAS Grains staff chose sprayed paddocks in their areas to minimise actual stripe rust yield loss. At differing stages of growth (flag leaf emergence to early milk) 0.5m sections of crop had all of their leaves, or every leaf except the flag, removed or covered in gaffer tape. All plots were replicated and had a suitable buffer. At harvest, rows were cut and hand threshed and heads were counted. To minimise bias from the small areas, the measurement of yield was in grams/head.

Results:

Table 18: Contributions of leaves in wheat around Victoria 2005

Hamilton	Mackellar
GS 39	7.5t/ha
Head+stem	56%
Flag	19-23%
Leaves 2+3	21-25%
all leaves taped	64%

Katamatite Irrig.	Whistler
GS65	5.5 t/ha
head+stem	70%
Flag	15%
leaves 2+3	15%
GS73	
head+stem	94%

Katamatite	Bowerbird
GS65	3.0 t/ha
head+stem	103%
flag	0%
leaves 2+3	4%
all leaves taped	108%
leaves 2+3 taped	115%

Kerang Irrigated	Chara
GS65	6.6t/ha
Head+stem	71%
Flag	29%
Leaves 2+3	0%
all leaves taped	112%
Leaves 2+3 taped	112%

Swan Hill	Yitpi
GS59	3.0t/ha
head+stem	93%
Flag	4%
leaves 2+3	3%
all leaves taped	97%
leaves 2+3 taped	102%

Katamatite East	Wedgetail
GS65	3.0t/ha
head+stem	121%
flag	-3%
leaves 2+3	-18%

Barooga Irrigated	Chara
GS65	6.5t/ha
Head+stem	63%
Flag	17%
Leaves 2+3	20%

Overseas Literature	
England	Winter wheat
head+stem	24%
Flag	43%
leaves 2+3	33%

South Aust 1969	unknown
head+stem	51-69%
Flag	24-30%
leaves 2+3	25-28%

Table 19: Contributions of leaves in wheat around Victoria 2004

Katamatite Irrig.	Whistler
GS65	5.0t/ha
head+stem	62.0%
Flag	17.0%
Leaves 2+3	21.0%

Kerang Irrig.	Chara
GS69	4.0t/ha
head+stem	72.0%

Quantong	Yitpi
GS65	1.0t/ha
head+stem	88.0%

Katamatite	Diamondbird
GS65	1.0t/ha
leaves 2+3	26.0%

Observations and Comments:
There were more sites and locations sampled in the 2005 season compared to the 2004 season. The data from 2005 was not dissimilar to the results from the small number of samples surveyed in 2004.

This experiment was developed in response to the 2004 stripe rust epidemic where English data in circulation suggested the head and stem contributed 25% to yield, while the flag leaf contributed ~ 40% to yield, and the remaining 35% of yield was contributed by leaves 2 and 3.

The Victorian data collected in 2004 and 2005 suggests that from flag leaf emergence onwards, the head, awns and stem are the greatest contributors to crop yield, however leaves still play a significant role in high yielding situations. In crops with a yield potential of less than 3t/ha, it was found that following Z39, between 88-100% of yield arises from the photosynthetic functions of the head, stem and awns. In crops yielding greater than 3 t/ha, it was found that following Z39, between 56-72% of yield is derived from the head and stems, with the remainder of yield being contributed by the leaves. As such, there is an advantage in extending the time that leaves remain green after Z39 in high yielding crops. In those surveyed paddocks where leaves contributed significantly to yield, the flag leaf contributed as much to yield as leaf two and leaf three combined. The varying times of leaf removal show that as the crop approaches maturity, it has a greater ability to achieve its yield potential without leaves.

While the relative importance of leaves declines as the crop matures, it is essential to maintain green leaf area prior to flag leaf emergence. Green leaves drive the accumulation of water soluble carbohydrates in the stem for use in grain filling when leaves senesce. Decisions to protect leaves from disease after Z39 should always be made after assessing the yield potential of the crop.

At Kerang and Katamatite, significant yield benefits from covering leaves with gaffer tape were observed. At Swan Hill, the taped crop yielded the same as the untaped or unstripped (normal) crop. The high yielding Hamilton long season site recorded an 8% gain in yield by taping compared to removal of leaves. The reason for the observed yield gain is most likely due to decreased water use by leaves, which improves water use efficiency. This suggests that these crops still senesced from lack of water or high temperature and evaporative loss. Where the leaves were taped, grain protein was similar to normal crop, whereas protein was decreased by 1-2% in plots where the leaves were removed. This indicates that the majority of N uptake into protein probably arises from the stem and root system.

Sponsors:
Farmer Co-Operators, various Victorian TOPCROP group members.
Thanks to TOPCROP agronomists for undertaking the gruelling effort of leaf removal.

North East Monitor Paddock 2005

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Telford
Growing Season Rainfall:
Annual Ave: 320 mm
2005 GSR: (Apr-Oct) 292 mm
Soil:
Type: various
pH (H_20): (0-10cm) variable
Sowing Information:
Sowing date: 13/6/05
Fertiliser: 100kg/ha MAP
Row Spacing: 22.5 cm
Paddock History:
2005 – Barley
2004 – Wheat
2003 – Canola
Plot Size: paddock
Replicates: 3

Key messages:

- Despite different yields, pH's and soil nitrogen values on different soil types, there was no difference in nitrogen uptake efficiency in the three monitored zones of the paddock.
- The crop responded by growing more bulk or Dry Matter (DM) where higher soil nitrogen levels existed.

Aim:
To measure differences in agronomic performance long term on three different soil types in the one paddock.

Method:
The paddock being monitored is paddock 44, part of the Riverine Plains Precision Agriculture project, which is situated at Telford, south of Yarrawonga. This paddock has been divided into three distinct areas using electromagnetic (EM) survey techniques. These are classified as High EM (a grey self mulching clay), Medium EM (red loam duplex common to the district) and Low EM (red duplex overlying fractured rock, a hill soil). Soil tests were taken to a depth of 60cm before sowing and head counts and dry matter were taken near harvest. The paddock was sown with 10 kg N/ha and topdressed with 37kg N/ha on the 8th September.

Results:

Table 20: Soil test results

Zone	High EM	Medium EM	Low EM
pH ($CaCl_2$) 0-10	6.5	5.4	5.6
pH ($CaCl_2$) 10-20	7.4	6.0	5.2
pH ($CaCl_2$) 20-40	8.2	7.7	5.6
pH ($CaCl_2$) 40-60	8.5	8.5	7.6
Available N 0-60 cm	92.0	66.0	73.0
Colwell P	52.0	72.0	57.0
CEC	22.0	10.4	12.9

Table 21: Crop results

Zone	High EM	Medium EM	Low EM
Variety	**Gairdner**	**Sloop**	**Sloop**
Heads/m^2	608	519	582
DM (t/ha)	13.2	11.2	9.7
N uptake @ Grain Fill (kg N/ha)	223	169	146
Yield (t/ha)	5.25	4.5	4.2
Protein (%)	9.5	10.0	10.0
N in grain (kg N/ha)	80	72	67
Total N available# (kg N/ha)	139	113	120
Mineralisation (kg N/ha)	84	56	26
% grain uptake	36	43	46

Total N available = soil N + fertiliser 47 kg N/ha

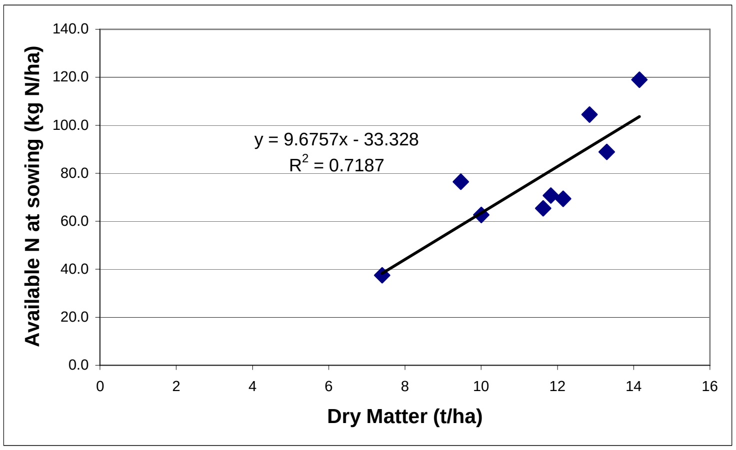


Figure 21. Dry Matter response from different soil nitrogen levels

Observations and comments:

There are noticeable differences in the pH of the soils in the different regions of the paddock (Table 20). The High EM grey clay soil has the highest pH and this continues to depth with a very alkaline subsoil, which is more like a Mallee soil. The low EM soil at the top of the hill has the most acidic topsoil and this continues to 20 cm, which indicates greater leaching over time. The pH of the paddock is within the tolerance range for plant growth, as the paddock has a good liming history.

The available N was highest in the High EM soil and similar in the medium and low EM areas. The Medium EM soil has the highest phosphorous level. The High EM soil has the highest cation exchange capacity (CEC) which is to be expected in soil with a higher clay content.

The results from the site are confounded by the fact that two barley varieties were used in different zones. A shortage of Sloop seed meant that Gairdner was required to finish the paddock and as such, was sown on the high EM area. The season suited Gairdner more than Sloop, thus Gairdner yielded considerably more on the high EM area than the Sloop on the medium and low EM areas. The nitrogen uptake, at between 40-44%, is below the targeted efficiency of 50%, however low N uptake efficiencies were common this season. There was no difference in nitrogen uptake between the different soil types. There is a potentially greater amount of mineralisation from the high EM zone but this may be because the rooting depth of the crop was below the 60cm tested.

Figure 21 indicates that Dry Matter (DM) production increased in response to increasing soil nitrogen levels at sowing. Plant head counts also increased in response to increasing available N at sowing (data not presented).

Sponsors:
The Grains Research & Development Corporation**,**
Farmer Co-Operators: Inchbold family, Telford, Victoria.

Insert Dovuro full page ad here

Stripe Rust Fungicide trial - Barooga

Authors: Michelle Pardy and Dale Grey

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Barooga
Growing Season Rainfall:
GSR: (Apr-Oct) 286 mm
Sowing Information:
Sowing date: 5/6/05
Fertiliser: 80 kg MAP/ha
Row Spacing: 30 cm
Paddock History:
2005 – Wheat
2004 – Canola
2003 – Wheat
Plot Size: 12 x 50cm cuts
Replicates: 3

Key message:

- An additional foliar fungicide treatment was required to prevent yield losses of up to 57% in H45 treated with a flutriafol fungicide (in furrow).

Aim:
To investigate the difference in yield between sprayed and unsprayed sections of a H45 crop treated with an in-furrow application of a flutriafol fungicide to control stripe rust.

Method:
H45 was sown at 85 kg/ha in early June with 80 kg MAP/ha treated with a flutriafol fungicide (in furrow). High levels of stripe rust were noticed in the paddock during mid September and the paddock was aerially sprayed with an Epoxiconazole fungicide on the 20th September 2005. The paddock borders were unsprayed (1 x swath width), with discolouration becoming evident in this area soon after spraying. At harvest 6 x 1 metre cuts (both sides of a 50 cm ruler) were taken in the sprayed and unsprayed sections. These were hand harvested and threshed.

Results:

Table 22: Benefits of a fungicide on a Highly Susceptible Variety

Treatment	Yield t/ha
H45 + fungicide	4.69
H45 – fungicide	1.99
Yield Loss	57%

Observations and comments:
There was a very large difference between the + and – foliar fungicide despite the application of an in furrow application of fungicide. In this instance, the in furrow fertiliser became ineffective in early September, allowing stripe rust to build up quickly on the highly susceptible H45. Where a foliar application of an Epoxiconazole fungicide was applied, the treated crop yielded 4.7t/ha and did not have high levels of screenings. In contrast, the untreated area yielded 57% less and had an extremely high level of screenings. The untreated area was darker due to the possible presence of saprophytic fungi, and was visually much thinner due to the amount of leaf area lost.

When growing highly susceptible varieties such as H45, the risk of yield loss continues right through the season and constant monitoring and action is required.

Sponsors:
Farmer Co-Operator: Barooga, NSW.

North East Stripe Rust Management Trial

Authors: Dale Grey and Michelle Pardy

Contact No: 03 5871 0600

Organisation: DPI Victoria, Cobram

Location: Bungeet
Growing Season Rainfall:
GSR: (Apr-Oct) 358 mm
Soil:
Type: red loam
pH (H_20): 5.7 (0-10cm)
Sowing Information:
Sowing date: 17/6/05
Fertiliser: 100 kg/ha MAP (sowing) + 80 kg N/ha Urea split at Z30 and Z31)
Row Spacing: 17.5 cm
Paddock History:
2004 – Canola
Plot Size: 1.4m x 15m
Replicates: 3

Key messages:
- In 2005 significant yield losses due to stripe rust were recorded for some wheat varieties.
- A variety of control options worked, the choice of which is a balance between cost and risk.
- A resistant variety unsprayed yielded the same as affected varieties with a full spray program.

Aim:
To evaluate the performance of several wheat varieties using various sowing stripe rust treatments, in a sprayed and unsprayed comparison.

Method:
The varieties Chara (adult plant resistance (APR) – stripe rust rating 3), Diamondbird (rust rating 4, since downgraded to a rating 3) and GBA Ruby (rust rating 8) were sown in a canola stubble to minimise root disease effects.
The treatments used were:

- Tebuconazole - a smuticide with no activity against stripe rust.
- Triadimenol - a broad spectrum smuticide with early stripe rust protection.
- Fluquinconazole - a broad spectrum smuticide with longer lasting stripe rust protection.
- Flutriafol - a fertiliser coating providing longer lasting activity against stripe rust.

These products were applied at maximum label rates.
Triadimefon at 1 L/ ha was sprayed at various times to control stripe rust infection.
The first spray was applied to the treatments showing the most rust on 19th September 2005 at Z31 for Chara and Z32 for Diamondbird, this was still at very low levels of rust at about 1/10,000 tiller infection. The second spray timings for some treatments were at Z39 for Ruby and Diamondbird on the 4th October. The last spray was on the 10th October 2005 applied to some Chara treatments at Z39.

Results:
The first signs of stripe rust were found at very low levels on the 8th September 2005, 83 days after sowing. All seed/fertiliser treatments showed some initial symptoms at this stage except Ruby. Ideal conditions were experienced for the spread and proliferation of the rust during the spring. By the 4th October 2005 Triadimenol and Tebuconazole treated seed plots had serious infections. Chara was the worst affected with almost every leaf infected at this stage. Ruby was still yet to experience any significant infection.

Table 23: Results for unsprayed treatments compared to Tebuconazole

Variety	Treatment	Tiller infect % 4th Oct	Top 3 leaf area % loss 27th Oct	Yield t/ha	Sowing treatment - % gain	Screenings %
Chara	Triadimenol	90	50.6	4.11	4	3.4
Chara	Flutriafol	13	15.6	4.72	16	2.2
Chara	Fluquinconazole	33	17.2	4.66	15	2.2
Chara	Tebuconazole	100	60.2	3.95		2.5
Ruby	Triadimenol	0.003	12.0	5.18		1.2
Diamondbird	Triadimenol	53	37.4	4.34	-3	3.4
Diamondbird	Flutriafol	6.7	19.7	5.10	13	1.8
Diamondbird	Fluquinconazole	0.007	31.4	4.95	10	1.9
Diamondbird	Tebuconazole	60	48	4.45		2.4
LSD (p<0.05)			17.7	0.46	NS	0.95
CV%			NS	5.6	NS	NS

Table 24: Results for treatments sprayed with fungicide

Variety	Treatment	Fungicide	Tiller Infect % 4th Oct	Top 3 leaf area % loss 27th Oct	Yield t/ha	Unsprayed % loss	Screenings %
Chara	Triadimenol	19 Sep + 10 Oct	0	4.7	5.26	22	1.7
Chara	Flutriafol	10-Oct	16.67	5.8	4.99	5	2.0
Chara	Fluquinconazole	10-Oct	37	16.3	5.12	9	2.0
Chara	Tebuconazole	19 Sep + 10 Oct	0	1.6	5.08	22	1.4
Ruby	Triadimenol	4-Oct	0	3.0	5.30	2	1.3
Diamondbird	Triadimenol	4-Oct	33	18.0	5.31	18	1.3
Diamondbird	Flutriafol	4-Oct	0.003	18.7	5.26	3	1.6
Diamondbird	Fluquinconazole	4-Oct	0	12.1	4.95	-1	1.3
Diamondbird	Tebuconazole	19 Sep + 10 Oct	0	14	5.03	12.2	1.7
LSD (p<0.05)				17.7	0.46	13	0.95
CV%				NS	5.6	NS	NS

Table 25: Economics for the different options

Variety	Treatment	No. Fungicide Sprays	Variable costs $/ha	Yield T/ha	Protein %	Gross Margin $/ha
Diamondbird	Triadimenol	1	240	5.31	10.7	$556
Ruby	Triadimenol	1	240	5.30	11.7	$555
Ruby	Triadimenol	0	225	5.18	11.8	$552
Chara	Triadimenol	2	255	5.26	10.7	$534
Diamondbird	Flutriafol	1	260	5.26	10.4	$530
Diamondbird	Flutriafol	0	245	5.10	10.6	$519
Chara	Tebuconazole	2	250	5.08	10.6	$512
Diamondbird	Tebuconazole	2	250	5.03	10.7	$504
Chara	Fluquinconazole	1	266	5.12	10.7	$502
Diamondbird	Fluquinconazole	0	251	4.95	10.4	$491
Chara	Flutriafol	1	260	4.99	10.7	$489
Diamondbird	Fluquinconazole	1	266	4.95	10.3	$476
Chara	Flutriafol	0	245	4.72	10.8	$463
Chara	Fluquinconazole	0	251	4.66	11.0	$448
Diamondbird	Tebuconazole	0	220	4.45	11.0	$448
Diamondbird	Triadimenol	0	225	4.34	11.0	$426
Chara	Triadimenol	0	225	4.11	11.1	$392
Chara	Tebuconazole	0	220	3.95	11.0	$373
LSD (p<0.05)				0.46	0.47	$67.4
CV%				5.60%	2.6%	8.3%

Observations and comments:
The longer acting treatments yielded higher than the short acting treatment when compared to a regular smuticide (Table 23). There was no effect of the shorter acting Triadimenol against rust, which was most likely due to the epidemic starting after its protection had run out. Diamondbird yielded better than Chara when unsprayed and only a smuticide was used. Diamondbird, when used with a longer acting treatment, yielded similarly to the unsprayed resistant variety, Ruby.

When plots were sprayed (Table 24), yield was the same irrespective of variety and treatment. Unsprayed plots suffered yield loss in the order of 12-22% compared to the nil treatment. For Diamondbird, there was no further yield gain from spraying after Fluquinconazole and flutriafol were used. The resistant variety Ruby showed no extra benefit from spraying.

Combinations of resistant varieties, one and two spray strategies and +/- seed/fertiliser treatments gave equivalent gross margins (Table 25). No single management strategy gave higher returns, so the choice of which to use comes more down to cost and attitude to risk. The cheapest option, if you are confident of your management, is to spend no money up front and act quickly when you have to. In the majority of seasons i.e. when stripe rust pressure is low and spring conditions aren't conducive to disease build up, then either zero or only one spray would be probably all that is required. However, in a season like last year, two sprays would be required to maximise yield. If you are not confident in your ability to respond quickly to disease build up, then some seed/fertiliser treatments can be justified. In many seasons, a seed/fertiliser treatment may be all that is required, however in a high pressure season like last year, this was often insufficient.

The choice of variety should not be taken lightly, take care to balance marketability, other disease resistances, agronomic adaptability and end point royalty against stripe rust resistance.

Sponsors:
Farmer Co-Operators: Alexander family, Bungeet, Victoria, and
IK Caldwell's (Bayer) for fungicide.

EverGraze - More Livestock from Perennial$

Authors: Angela Avery[AB], Geoff Saul[AC], Paul Sanford[AD], Michael Friend [AE]

Contact No: Angela 02 6030 4500, Geoff 03 5573 0900, Michael 02 6933 2285, Paul 08 9892 8475

Organisation:
[A]CRC for Plant-Based Management of Dryland Salinity, University of Western Australia, Crawley, WA
[B]Primary Industries Research Victoria, Rutherglen, VIC
[C]Primary Industries Research Victoria, Hamilton, VIC
[D] Department of Agriculture Western Australia, Albany, WA
[E] Charles Sturt University, Wagga Wagga, NSW

Key Messages:

- New perennial based animal grazing systems are urgently needed in the high rainfall (above 600mm) zones that will achieve a significant reduction in recharge over annual pasture systems and increase profitability above traditional animal enterprises. Traditional animal production systems in the high rainfall areas of Australia have been based on annual plants and have been shown to use insufficient water to avoid the spread of dryland salinity.
- If new systems can be developed using deep-rooted perennial plants, it will be possible to significantly increase water-use and reduce the risk of salinity. However, these systems must be profitable if farmers are to implement them.
- Previous work has shown that although a perennial-pasture based animal production enterprise offers strong prospects for profitability, the capacity to reduce deep drainage in the high rainfall (>600 mm/year) zone of southern Australia is limited, with the possible exception of kikuyu. Lucerne also offers significant promise, however many soils in the high rainfall zone are either too acid or waterlogged for it to grow well. To be significantly more sustainable, grazing systems must achieve considerable reductions in recharge to groundwater.
- Animal production enterprises also have to compete with cropping systems in terms of profitability. New techniques such as raised beds and crop varieties are increasing the potential for crops to be grown in this region.

Aim:
This project aim is to design, research and validate new livestock production systems in high rainfall recharge zones that achieve the dual outcome of:

(a) a reduction in recharge significantly over annual systems and;
(b) an increase in profitability by 50% (above best practice animal enterprises).

Method:
Unlike many projects that begin with on-ground activities and assess their impact during or after the project, the EverGraze – More Livestock from Perennial$ project began with a period of intensive bio-economic and hydrological modelling together with a series of farmer workshops to set the scene for on-ground experimentation and demonstration.

Farmers and researchers were consulted in three high rainfall catchments (Murrumbidgee (NSW), Glenelg-Hopkins (VIC) and South coast of WA) to help develop future scenarios. At the same time, pasture growth outcomes for different species, soil types and stocking rates were modelled.

Farmers and researchers then came together to discuss the results and assist in further developing the next phase of research that could demonstrate meat production systems capable of achieving the project's aims.

Management implications:
The project is developing the concept of 'High Performance Lamb' to maximise the production of meat from sheep while increasing water use from perennial pastures. High Performance Lamb will achieve multiple births, maximum weaning rates and low numbers of unproductive days in terms of both reproduction and lamb growth.

A High Performance Lamb enterprise also includes short mating or synchronised mating to keep lambing to six weeks, supplementation with high quality feed seven days before lambing for improved colostrum production and creating a protective environment for better lamb survival.

These new animal production systems will require farmers to adapt their management to allow for a more intensive and complex enterprise.

Results:
The modelling undertaken highlighted that meat production systems have the greatest potential to profit from summer-active perennial farming systems. The modelling showed that these systems can significantly increase profitability and significantly reduce recharge compared to traditional wool systems.

The systems were identified by designing farm scenarios for different perennial-based pasture systems for each catchment. The design process involved consultation in the catchment. These scenarios were then used as inputs into two models to provide both profitability and off-site impacts at the farm scale.

Farmers, researchers and catchment managers in each catchment then reviewed the farming systems developed for 'realism' of what is currently undertaken, and what is feasible or possible.

New South Wales
In this research, valley floors can be expected to respond to new pasture systems, but less is known about the mid-slopes. Rows of woody perennial shrubs have been planted in various combinations with perennial pastures to look for complementarity. Trees and perennials pasture has been planted to achieve reduced run-off and also provide microclimate benefits, including protection for lambing ewes, essentially a maternity ward.

Two management applications have been identified as having potential to increase profits with systems based on summer-active perennial pastures. These are the "Split Joining" and "Later Lambing" management practices.

- "**Split Joining**" involves joining a portion of the flock to a terminal sire earlier in the year to enable first-cross lambs to be finished by the end of the year. The remainder of the flock is joined later in the year to Merinos so lambing coincides with peak pasture production.

- "**Later Lambing**" involves joining ewes later for a September lambing. This has the advantages that peak feed requirement of the ewes coincides with peak feed supply and that producers may be able to capture high sheep meat prices.

Victoria

The project will establish a detailed experimental site on the basalt plains in the Glenelg-Hopkins catchment in south-west Victoria to determine interactions between land type, pasture type, animal type and productivity and water use. Within this site, component studies are being conducted on the effect of shelter on lamb survival and the ecology of tall fescue. A novel idea of "pasture hedgerows" is also being be tested to protect lambs from the cold westerly winds during the September lambing. "Pasture hedgerows" also increase the extent of perennials on the farm.

The experiment will use summer active pasture to increase ewe ovulation rates and "hedgerows" of perennial grass to improve lamb survival. Lambs will be finished in a specialist lamb finishing system.

At Hamilton, two different merino genotypes will be used. Centreplus ewes have been purchased from central NSW. These large framed merino's are around 60 kg when condition score 3 and have been selected for high weaning percentages. The Centreplus sheep will be compared with a Victorian merino genotype selected for similar wool cut and micron but of smaller frame size and a typical weaning percentage.

In addition to the experimental site, demonstration sites have been established across the Glenelg Hopkins and Corangamite catchments. The research team is working with farmers who are using summer active perennial species, to determine the effects on key animal parameters (liveweight, weaning weight), water use and impacts on whole farm profitability.

Modelling will be used to extend the results to other locations and enterprises and evaluate the overall impacts of the new farming systems on water, soil and animal production at a catchment scale.

Western Australia

Across five soil types in the South Coast agricultural region a total farming system with a range of different summer-active perennials such as kikuyu and lucerne will be tested with the High Performance Lamb enterprise. This farming system will also consider wind erosion, water-repellent soils, soil acidification and waterlogging.

In parallel, research will be undertaken to address winter pasture production, ovulation rates, and lamb survival.

Research findings will be incorporated into the 'future' farming system. Modelling will be used to direct the management of experimental sites, as an experimental control for systems, to explore results and extend the research findings.

Sponsors:

CRC For Plant-Based Management of Dryland Salinity, Meat & Livestock Australia, DPI Victoria, CSIRO, Glenelg Hopkins CMA, South Coast Regional Initiative Planning Team, Albany Eastern Hinterland, Department of Agriculture Government of Western Australia, NSW DPI, The University of Western Australia, Murrumbidgee Catchment Management Authority and Corangamite CMA.

Companion cropping lucerne increases winter production

Author: Rob Harris

Contact No: 02 6030 4500

Organisation: DPI Victoria, Rutherglen Centre

Location: DPI Rutherglen
Growing Season Rainfall:
Annual: 742 mm
GSR: 402 mm
Soil:
Type: Yellow Dermosol (fine sandy loam)
pH (H_20): 5.5
Sowing Information:
Sowing date: 15/06/05
Fertiliser: 100 kg/ha DAP
Row Spacing: 7 inch
Paddock History:
2005 – Lucerne
2004 – Lucerne
2003 – Lucerne established under barley
Plot Size: 8.5 x 10 m
Replicates: none

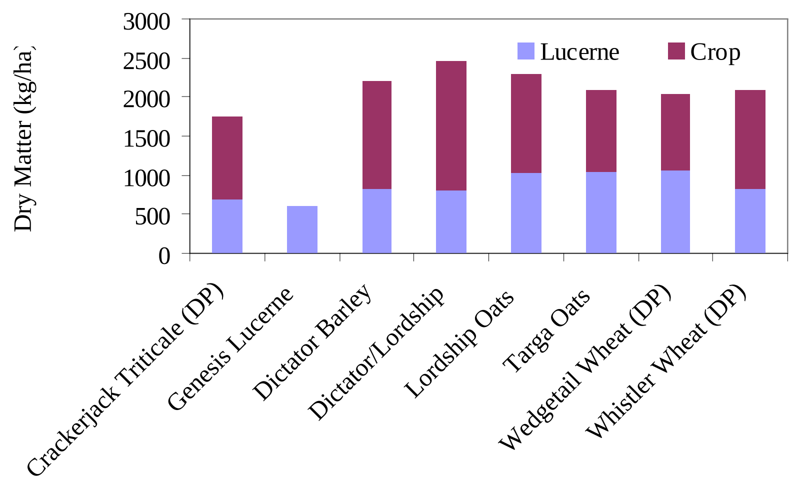
Key message:

- Sowing dual purpose and forage cereals in an existing lucerne stand increased winter dry matter production by over 300% at Rutherglen.

Aim:
To compare winter dry matter production of lucerne grown alone with lucerne companion cropped with dual purpose and forage cereals.

Method:
An unreplicated demonstration site was established at DPI Rutherglen, where different dual purpose and forage cereals were sown into a three-year-old stand of lucerne (cv. Genesis) with one plot of pure lucerne retained. All the cereals were sown at 100 kg/ha with DAP applied with the seed. In early August, all plots were top-dressed with 60 units of nitrogen. On the 1st of September 2005 aboveground dry matter was cut from five randomly placed quadrats (0.5 x 0.5 m) within each plot, combined together before being dried for 48 hours and weighed.

Results:



(DP) indicates dual-purpose companion crops.

Figure 22. Comparison of dry matter production from stand-alone lucerne with companion cropped lucerne

Observations and comments:
In all cases where cereals were sown into lucerne a substantial increase in dry matter production was observed (Figure 22). Lucerne is largely dormant over the winter period; even highly winter active lucerne varieties produce very little dry matter over winter. Companion cropping can increase productivity because cereal crops continue to grow at low temperatures and produce more dry matter compared with lucerne. The additional growth promoted through companion cropping may be an attractive option for livestock production systems common on mixed farms. This work demonstrates that growing substantially more dry matter through companion cropping is possible, however more research is needed to identify ways of profitably utilising this additional feed.

The use of dual-purpose (graze and grain) companion crops may be a more attractive option, giving farmers the flexibility of growing crops for a range of different end uses, and therefore minimising some of the risk associated with companion cropping. For instance dual-purpose companion crops could be used to fill the winter feed gap, and then depending on seasonal conditions, give farmers the option of either continuing to graze, cutting for forage, or growing the crop out for grain production.

Sponsors:
Department of Primary Industries Victoria,
Cooperative Research Centre for Plant Based Management of Dryland Salinity, and
The Grains Research & Development Corporation.

The impact of applying nitrogen to companion crops

Author: Rob Harris

Contact No: 02 6030 4500

Organisation: DPI Victoria, Rutherglen

Location:
North Boorhaman
Growing Season Rainfall:
Annual: 572 mm
GSR: 395 mm
(3 yr average)
Soil:
Type: Red Sodosol
(light sandy loam)
pH (H_20): 6.8
Sowing Information:
Sowing date: 4/06/2005
Fertiliser: 100kg DAP/ha at sowing.
Row Spacing: 7 inch
Paddock History:
2005 – crop/lucerne
2004 – crop/lucerne
2003 – crop/lucerne
Plot Size: 8m x 6m
Replicates: 4

Key message:

- Top-dressing nitrogen to stand-alone cereals and companion crops (cereal sown into lucerne) increased grain yield on average by over a tonne/ha.

Aim:
To compare the impact of applying nitrogen to companion crop (cereals sown into lucerne) with cereals growing alone.

Method:
A replicated field experiment with three treatments including cereal (wheat and triticale) sown into lucerne, stand alone cereal and stand alone lucerne was established at North Boorhaman in North East Victoria. Each main plot was randomly split into subplots, with one subplot top-dressed with additional nitrogen in the form of urea.

Observations and comments:
Over the three years of the experiment top-dressing between 60 and 100 units of nitrogen resulted in grain yield increases of 1.1 and 1.2 t/ha in the companion crops (cereals sown into lucerne) and sole cereals respectively, compared with crops receiving no additional nitrogen (Table 26). Irrespective of applying nitrogen to cereals growing alone or with lucerne, the same improvement in grain yield was observed.

Applying nitrogen to cereals growing with lucerne may be a riskier option than top-dressing nitrogen to cereals growing alone. Optimising yield through nitrogen application during the vegetative growth phase (application in July/August) may be to the cereal's detriment late in the growing season when competition with lucerne for soil moisture may exacerbate "haying off" if seasonal conditions become dry. Given the increasing cost of urea, this strategy should be viewed with some caution.

Results:

Table 26: Crop yield responses to additional nitrogen at North Boorhaman
(all treatments received 20 units of nitrogen at sowing)

Year	GSR	Nitrogen Supply (kg/ha)	Crop type	Cereal Only	Cereal with lucerne	LSD (p<0.05)	Yield reduction (%)
2003	415	20	Wheat	3.5	2.6	0.8	26
		80	Wheat	4.0	3.1	0.8	23
LSD (p<0.05)				0.3	0.3		
2004	321	60[A]	Triticale	3.1	2.0	0.6	35
		120	Triticale	3.6	2.5	0.6	31
2004	405[B]	60[A]	Triticale	4.0	3.0	0.6	25
		120	Triticale	5.7	4.5	0.6	21
LSD (p<0.05)				0.4	0.4		
2005	448	20	Wheat	3.2	2.4	0.3	25
		120	Wheat	5.3	4.1	0.3	23
LSD (p<0.05)				0.3	0.3		
Mean		**Low (20-60)**		**3.5**	**2.5**		**28**
		High (80-120)		**4.7**	**3.6**		**24**

[A]40 units of N top-dressed.
[B]84 mm of irrigation applied in October 2004

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Companion cropping shows potential at North Boorhaman

Author: Rob Harris

Contact No: 02 6030 4500

Organisation: DPI Victoria, Rutherglen

Location:
North Boorhaman
Growing Season Rainfall:
Annual: 572 mm
GSR: 395 mm
(3 yr average)
Soil:
Type: Red Sodosol
(light sandy loam)
pH (H_20): 6.8
Sowing Information:
Sowing date: 4/06/2005
Fertiliser: 100kg DAP/ha
Row Spacing: 7 inch
Paddock History:
2005 – crop/lucerne
2004 – crop/lucerne
2003 – crop/lucerne
Plot Size: 8m x 6m
Replicates: 4

Key message:

- Over a three-year period companion cropping (sowing cereals into lucerne) decreased grain yields of cereal by 27% and annual lucerne dry matter production by 58% compared with stand alone cereal crops and lucerne respectively.

Aim:
To compare the productivity of cereals sown into lucerne (companion cropping) with cereal and lucerne crops growing alone.

Method:
A replicated field experiment with three treatments including cereal (wheat and triticale) sown into lucerne, stand alone cereal and stand alone lucerne was established at North Boorhaman in North East Victoria.
Grain yield from the cereal crops and annual lucerne dry matter production were measured.

Results:

Table 27: Crop and lucerne yields at North Boorhaman (lucerne plant density of 10-7 plants/m^2)

Year	Rainfall May-Apr	Crop type	Crop grain yield (t/ha)				Lucerne DM yield (t/ha)[A]			
			Cereal Only	Cereal with lucerne	LSD (P<0.05)	Yield reduction (%)	Lucerne only	Lucerne with cereal	LSD (P<0.05)	Yield reduction (%)
2003/04	552	Wheat	3.8	2.8	0.8	26	11.0 (2.3)	3.6 (1.7)	1.8 (0.3)	67
2004/05	596	Triticale	3.4	2.3	0.6	32	8.9 (3.4)	4.7 (3.8)	1.2 (n.s)	47
2004/05	680[B]	Triticale	4.8	3.7	0.6	23	10.8 (3.6)	5.3 (4.0)	1.2 (n.s)	48
2005/06	517[C]	Wheat	4.3	3.3	0.3	23	7.1 (0.4)[C]	2.1 (0.5)[C]	1.3 (n.s)	70[C]
Mean			**4.1**	**3.0**		**27**	**9.3 (2.4)**	**3.9 (2.5)**		**58**

[A]Dry matter measured from May through to the following April
[B]84 mm of irrigation applied in October 2004
[C]Rainfall and lucerne production measured to the end of January 2006
numbers in brackets equals summer lucerne production

Observations and comments:
Over the three years of the experiment sowing cereals (wheat and triticale) into lucerne (companion cropping) resulted in an average grain yield reduction of 27% compared with cereals growing alone. Whilst annual lucerne production from companion cropping was reduced by 58% compared with sole lucerne.

The penalty from companion cropping appears high, however economic analysis needs to value not only the loss in grain yield, but also the gain in summer lucerne production. Assuming companion crops produce feed grain (AGP $112/t) and sole crops milling grain (APW $133) and that summer lucerne dry matter is worth $150/t for hay, the average gross income from companion crops in Table 27 would be $711/ha compared with $545/ha from the sole crop. Whilst this is a crude analysis, it does show that companion cropping can generate out-of-season income, and that in seasons of high summer rainfall there is potential to recoup the initial loss in grain income through subsequent lucerne production.

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Long Term Agro-ecological Experiments: RGL6

Author: Philip Newton

Contact No: 02 6030 4500

Organisation: DPI Victoria, Rutherglen

Location: Rutherglen
Growing Season Rainfall:
Annual: 741.9 mm
GSR: 481.9 mm
Soil:
Type: Red Vertosol
pH (H_20): 5.5
Sowing Information:
Sowing date: **16 June**
Fertiliser: 10 kg P/ha
Row Spacing: 17 cm
Paddock History:
2005 – Wheat, lupins
2004 – Wheat, lupins
2003 – Wheat, lupins
Plot Size: 20 m x 1.75 m
Replicates: 4

Key message:

- Long term rotation of wheat and lupin enabled wheat yields similar to district averages to occur in favourable seasons. Continuous wheat yields were unable to respond to the same extent. Lupins showed the capacity to produce comparable yields to wheat in 2005 after several poor years.

Aim:
To investigate the long-term trends in crop yields, soil pH and nitrogen cycling under continuous cropping of wheat and lupin rotation phases.

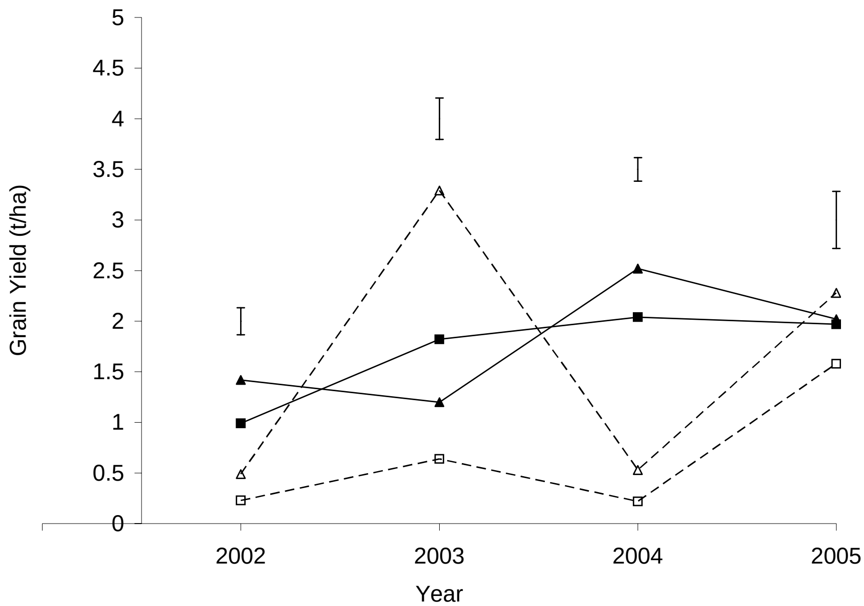
Method:
The rotation of grain legumes (RGL6) experiment commenced in 1977 almost 30 years ago. The treatments consist of continuous wheat, continuous lupins and phase replication of wheat – lupin and lupin – wheat rotations enabling comparisons in each season.

The only fertiliser inputs have been phosphorus, either with starter nitrogen of 20 kg/ha or with no nitrogen. In 2005 there was no nitrogen applied although starter N has been used at times in the past. The wheat variety was Diamondbird and the narrow leaf lupin was Jindalee. Weeds were suppressed with pre-emergent and knock-down mix before sowing and ryegrass was spray-topped with a desiccant after seed set.

Results:

Table 28: Grain yields of continuous wheat, wheat-lupin and lupin-wheat rotations and continuous lupins at Rutherglen 2005

Rotation treatment	Grain yield (t/ha)
Wheat-Wheat	1.97
Wheat-Lupin (Lupin 2005)	2.02
Lupin-Wheat (Wheat 2005)	2.28
Lupin-Lupin	1.58
LSD ($p<0.05$)	0.47



Wheat-wheat (solid squares), lupin-lupin (open squares), wheat-lupin (solid triangles) and lupin-wheat (open triangles). Error bars denote twice the standard error of the difference (SED).

Figure 23. Recent yields of wheat and lupin rotations

Observations and comments:

The maximum yield of wheat in 2005 was 2.8 t/ha compared to 2.2 t/ha for lupins. After 29 years of continuous wheat, grain yield was not significantly different to that of wheat in rotation with lupins in 2005 (Table 28). However, while there appeared little additional nitrogen benefit above soil mineralisation, wheat yields in rotation with lupins were significantly greater than continuous lupins (Table 28). Recent seasons have shown that wheat following lupins is more likely to benefit from additional N and break in root disease than lupins, which seem to suffer serious root disease complexes even after a years rotation break (Figure 23). However, lupins may also be able to take up more adsorbed phosphorus from the soil after a long history of sub-optimal fertiliser inputs.

Recent yield trends show (a) the response of wheat in 2003 following the drought in the previous year (two years of fertiliser and mineralisation of nitrogen) and (b) the inability of continuous wheat to exceed 2 t/ha.

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The Grains Research & Development Corporation.

Long Term Agro-ecological Experiments: SR1

Author: Philip Newton

Contact No: 02 6030 4500

Organisation: DPI Victoria, Rutherglen

Location: Rutherglen
Growing Season Rainfall:
Annual: 741.9 mm
GSR: 481.9 mm
Soil:
Type: Red Vertosol
pH (H_20): 5.5
Sowing Information:
Sowing date: 5 July 2005
Fertiliser: 20 kg P/ha
Row Spacing: 29 cm
Paddock History:
2005 – Faba Beans (Fiesta VF) or subclover (Trikkala)
2004 – Wheat or barley
2003 – Wheat, canola or faba beans
Plot Size: 20 m x 4.5 m
Replicates: 4

Key message:

- Legumes in the cropping rotation are vulnerable to root diseases and waterlogging under both stubble burning and stubble retention. However, legume phases such as subclover allow increased opportunities for integrated weed control strategies using non selective herbicides.

Aim:
To investigate the effects of stubble management and tillage system on crop production, nutrient cycling, water use and soil health in cereal, canola, pulse and subclover pasture rotations.

Method:
The stubble retention (SR1) experiment at Rutherglen commenced in 1980. It has three combined stubble and direct drilling (DD) tillage treatments consisting of (1) stubble retained (DDR), (2) stubble burnt (DDB) and (3) a conventional cultivation of two passes with a scarifier before sowing with stubble burnt (CCB). Crop rotations under each of the direct drilling treatments includes a two year rotation of cereal – grain legume from 1980 (wheat - faba bean), as well as a three year rotation incorporating canola (faba – canola – wheat) and a five year rotation including subclover (cv. Trikkala) pasture phase (sub – sub – canola – wheat – barley) from 2001.

Fertiliser was applied at 20 kg P/ha as grain legume super at sowing. No Nitrogen (N) was applied as the ability of pulses to supply nitrogen is being tested in each rotation. Weeds were controlled by a single pre-sowing application of both knockdown and residual herbicides and ryegrass was spray-topped with a desiccant after seed set in the faba beans and subclover. Dry matter of crops and pasture at anthesis was determined by cutting two quadrats (each 1 m^2) from plots at ground level and combining them. This sample was also used to find the amount of nitrogen derived from the atmosphere (NDFA) by analysing it for the abundance of naturally occurring ^{15}N in the crop relative to a ryegrass reference species.

Results:
Grain yields of faba bean were low (Table 29) compared to both long-term and district averages due to the late start to the season and waterlogging during early growth. Yields ranged from 0.3 to 1.9 t/ha but neither stubble management nor rotation significantly ($p<0.05$) affected the grain yield of faba bean (Table 29). Similarly there were no significant treatment effects on the dry matter of faba bean at flowering, although dry matter production in the subclover was less than for faba bean (Table 30).

Table 29: Effect of stubble, tillage and rotation on mean grain yields of faba bean

Stubble/tillage	Grain yield across rotations (t/ha)	Rotation	Grain yield across stubble management (t/ha)
Retained / direct drill	0.78	2 year	0.67
Burnt / direct drill	0.67	3 year	0.86
Burnt / conventional cultivation	0.87	5 year*	-
LSD (p<0.05)	0.26		0.21

* Subclover pasture in fifth year of rotation

Table 30: Effect of stubble, tillage and rotation on anthesis dry matter of faba bean and subclover at anthesis 31st October 2005

	Dry matter (kg/ha)		
	2-year rotation	3-year rotation	5-year rotation
Stubble/tillage	Faba bean	Faba bean	Subclover
Retained / direct drill	1387	1308	296
Burnt / direct drill	1403	1329	354
Burnt / conventional cultivation	1700	-	-
LSD (p<0.05)		616	

Observations and comments:

Conservation of soil moisture at depth under the five year rotation DDR treatment before sowing was a disadvantage in terms of waterlogging compared with the CCB treatment, which initially had a drier soil profile. The impact of ryegrass competition on the growth of the crop appeared to increase following waterlogging during the early part of the season. Dry matter of faba bean (Table 30) was highly variable because of uneven plant establishment. In contrast, an even plant establishment of subclover was achieved despite low dry matter growth at anthesis.

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Understanding subsoil constraints in the high rainfall zone of SE Australia

Authors: Philip Newton, Doug Crawford, Richard MacEwan, Tim Clune, Adam Inchbold

Contact No: 02 6030 4500

Organisation: DPI Victoria, Rutherglen

Location: Yarrawonga
Growing Season Rainfall:
Annual: 574 mm
GSR: 335 mm
Soil:
Type: Red Sodosol/Grey Vertosol
pH (H_20): 5.96
Row Spacing: 17cm
Paddock History:
2005 – Barley
2004 – Wheat
2003 – Canola
Plot Size: paddock scale
Replicates: spatial

Key message:

- Preliminary analysis of variation in sub soil conditions in the High Rainfall Zone of SE Australia shows that there is a useful link between sub-soil parameters, topography and grain yield. Further definition of these relationships will allow development of recommendations for assessment of yield maps and recommendations for spatial management of crops for productivity gains and reduced environmental impacts.

Aims:

1. To determine variation in subsoil properties using remotely sensed subsoil properties ground-truthed by soil sampling.
2. To find out how much variation in yield of grain crops in the high rainfall zone (HRZ) of SE Australia can be explained by remotely sensed soil properties.
3. To formulate recommendations and tools for spatial management of crops.

Method:

In order to investigate the above linkages, a number of sites were selected across the high rainfall zone (HRZ) for remote sensing of soil properties. This note briefly reports on the results of work undertaken at the Riverine Plains Inc precision agriculture site at Yarrawonga (NE Vic.) on paddocks 45 and 49. Other sites chosen include Naracoorte (SA), Lake Bolac (SW Vic.) and Marrar (NSW). The soil data collected remotely was electromagnetic induction, radioactive potassium (K) and topography. Data was collected at a grid spacing of 20 m on 14th February 2005 using EM38 and EM31 sensors mounted on an ATV bike and coupled to a global positioning system (GPS) accurate to 10 cm. Soil cores were taken in transects down slope at spacings of 30m to ground-truth the EM38 readings. Soils were analysed using standard wet chemistry methods (eg. pH, $EC_{1:5}$) or mid-infrared (MIR) reflectance analysis. Yield maps for the site were obtained from the farmer co-operators.

Results:

Soil water content, salinity and clay content are directly related to the value of the apparent conductivity (EC_a) reading. EC_a values are designated as salinity in Figure 24. Soil water content at the time of the survey ranged from 5-32% (v/v) in the topsoil (0-10 cm), from 10-50% (20-30 cm) and 20-52% (30-50 cm) in the subsoil. These values in paddock 49 reflected residual water present in the subsoil following heavy summer rains. However, soil water content in paddock 45 was lowered by actively growing lucerne (Figure 24).

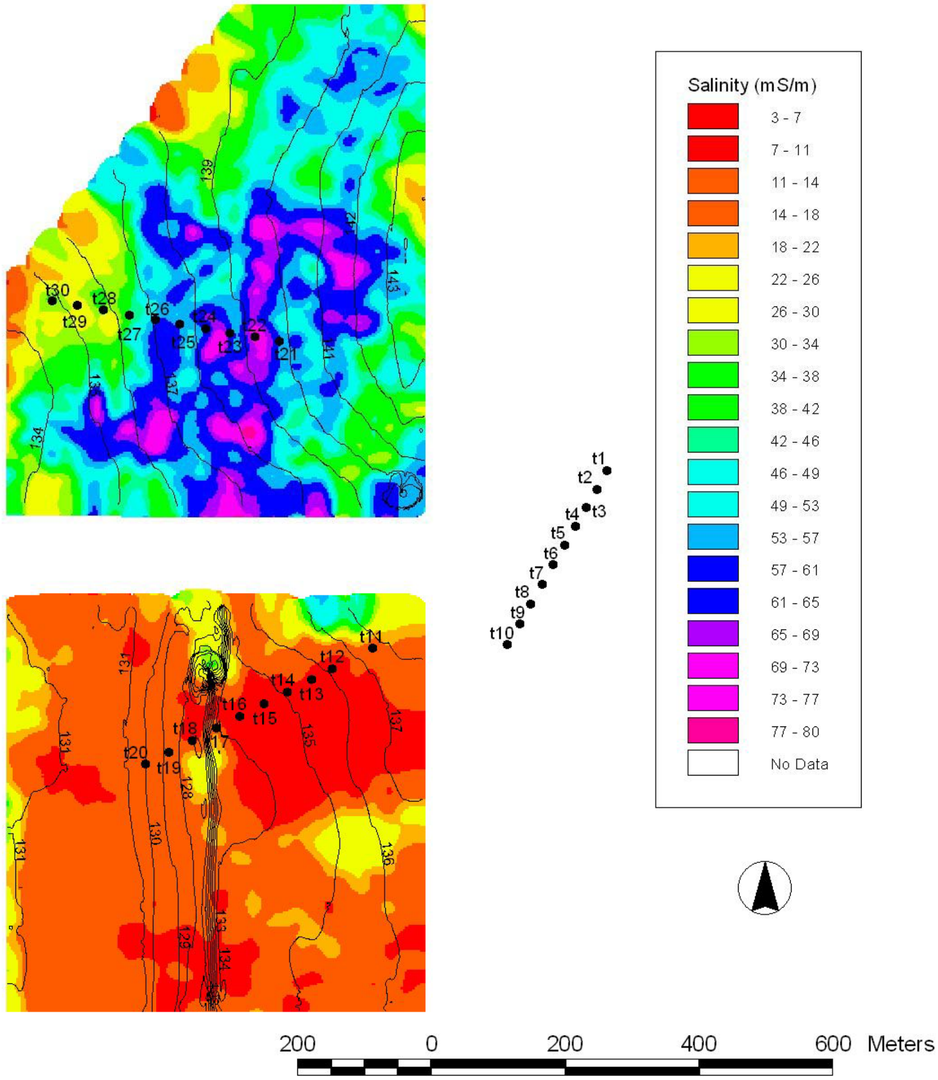

Figure 24. Colour maps of apparent conductivity (as salinity) surveyed in paddocks 49 (top), 45 (bottom). Sample cores are indicated by dots. Samples 1-10 were taken in adjacent paddock 44. Elevation is indicated by contour lines.

Soil properties averaged down the profile (depth weighted average) were compared to topographic and remotely sensed data using wet chemistry (Table 31) and (MIR) analyses (Table 32). EC_a was measured using vertical (EM38v) and horizontal (EM38h) methods.

Table 31: Correlation (*r*) between site survey data (position in transect, elevation, EM38, EM31, radiometric K) and wet chemistry ($EC_{1:5}$, pH $CaCl_2$) at Yarrawonga for paddock 49

Soil analyses	Position in transect (m)	Elevation (m)	EM38h	EM38v	EM31	K
$EC_{1:5}$	0.679	-0.456	0.872	0.868	0.879	0.264
pH($CaCl_2$)	0.582	-0.212	0.742	0.754	0.771	-0.153

Table 32: Correlation (*r*) between site survey data and selected mid-infrared (MIR) analyses including cation exchange capacity (CEC), clay (%), exchangeable sodium percentage (ESP), volumetric water content at lower limit (15 bar V%), volumetric water content at field capacity (10 kPa V%) and organic carbon percentage (OC) at Yarrawonga for paddock 49.

Soil analyses	Position in transect (m)	Elevation (m)	EM38h	EM38v	EM31	K
CEC	0.764	-0.515	0.627	0.659	0.656	0.057
Clay	0.700	-0.481	0.492	0.53	0.523	0.025
ESP	0.556	-0.222	0.736	0.728	0.742	-0.009
15bar V%	-0.776	0.491	-0.428	-0.514	-0.507	0.005
10kPa V%	-0.736	0.218	-0.565	-0.626	-0.633	0.168
OC	0.356	-0.129	0.501	0.523	0.523	-0.075

Observations and comments:

Remotely surveyed data was not located at the same points as the soil samples. Therefore the variability in EC_a for paddock 49 (Figure 24) was well represented by the sampled transect, as shown in the correlation between the data in Table 31 and Table 32. The radiometric data was uniformly distributed across each of the survey paddocks and was not well correlated with soil properties (Table 31 and Table 32).

The strong positive and negative correlation between position in transect, elevation, EM38h and EM38v readings, shows that the ability of the survey data to predict crop yield would be enhanced by consideration of all the parameters shown in Table 31 and Table 32. The fact that there was a good correlation between the MIR data and position in the transect suggests that a useful spatial representation of soil properties with yield across the paddock as a whole is likely. Good positive correlation between grain yield and EM38h shown for triticale (paddock 45; Figure 25a) contrasted with negative correlation for canola (paddock 49; Figure 25e), which may have been influenced by the disparity in moisture content and EC reading (Figure 24). Interestingly there was a positive correlation between grain yield with $EC_{1:5}$ for triticale (Figure 25b), but little if any correlation of radiometric potassium (K; Figure 25c), surface pH (Figure 25d) and yield of wheat in paddock 49 (Figure 25f).

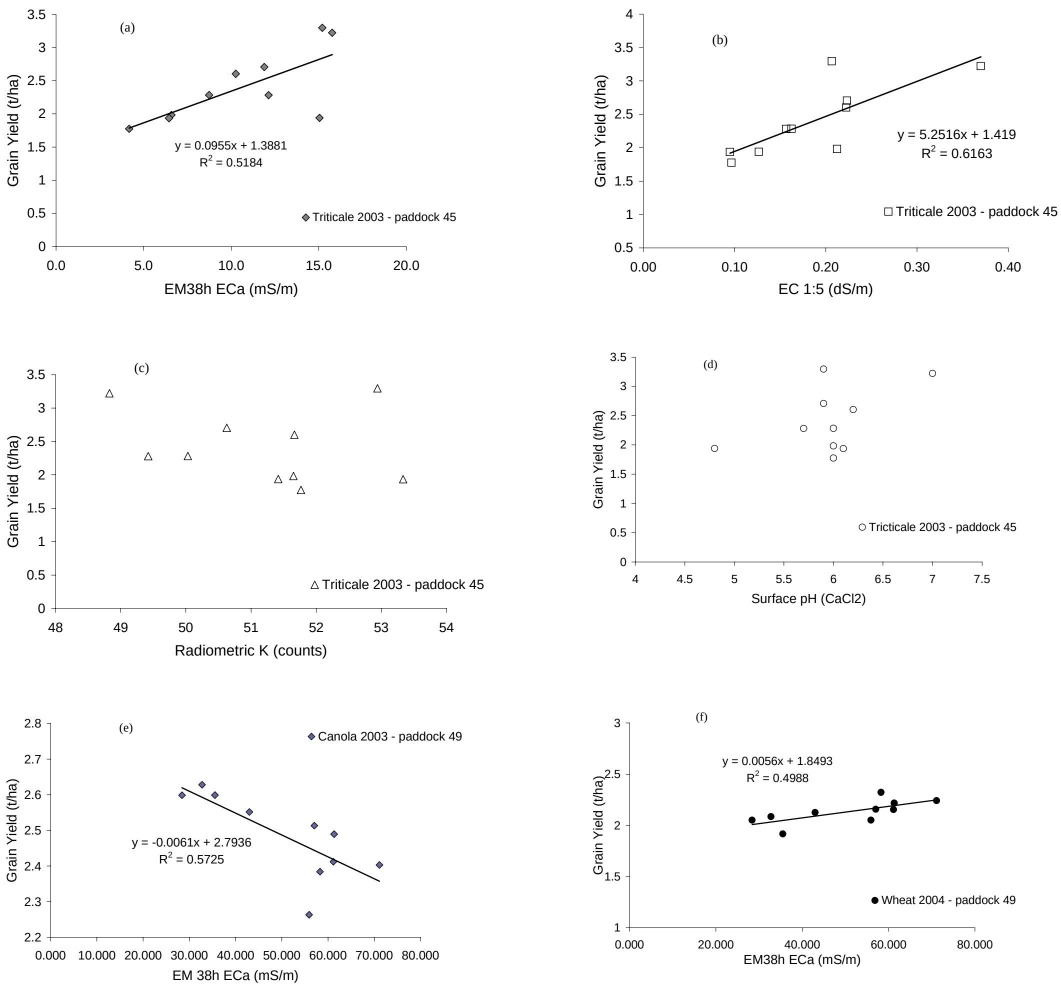

Figure 25. Grain yields of paddock survey variables and soil properties determined from sample cores (a) Triticale vs. EM38h, (b) Triticale vs. $EC_{1:5}$, (c) Triticale vs. radiometric K, (d) Triticale vs. surface pH ($CaCl_2$), (e) Canola vs. EM 38h and (f) Wheat vs. EM38h

Further spatial analyses are being carried out to further quantify the relationships between grain yield and soil properties in the HRZ.

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Inter row sowing and no-till – it works!

Authors: Matt McCallum

Contact No: 0438 895 167

Company: Ag Consulting Co, Ardrossan SA

Key message:
- Inter row sowing in no-till systems works well and can increase crop profits.

Background:
Successful establishment of crops in paddocks with high cereal stubble loads continues to be an issue for stubble retention and no-till. Efficacy of soil applied herbicides (Dual, Diuron, Treflan etc.) is also a big problem with stubble, particularly given the heavy reliance of these herbicides in no-till. The advent of 2 cm autosteer systems can help solve this issue by leaving most of the stubble standing and sowing between the rows next year. In addition, wider row spacings (9" to 12") and knife points in no-till concentrate soil-borne pathogens in these stubble rows. Using autosteer this creates an opportunity to sow next years crop away from last years stubble row to minimise the impact of disease. In response to these issues, a series of experiments have been set up across Australia to investigate the agronomic benefits of autosteer in no-till.

Yield benefits from inter row sowing
Yield increases for wheat-on-wheat have been measured across a number of sites over the last two years (Table 33). Less soil-borne disease on the inter row has been the major contributing factor to this difference, but not always (e.g. Hart 2005). Other factors include better plant establishment with inter row sowing in stubble retained systems due to less clumping.

Table 33: Wheat-on-wheat yields in inter row sowing experiments 2004/05

Site	Sowing row	Yield t/ha	% increase	Disease effect
Sandilands SA 2004	Inter row In row	4.11 3.88 (LSD 5% = 0.21)	6%	Take-all
Tamworth NSW 2004	Inter row In row	2.51 2.30 (LSD 5% na)	9%	Crown rot
Sandilands SA 2005	Inter row In row	3.74 3.42 (LSD 5% = 0.31)	9%	CCN and Take-all
Hart SA 2005	Inter row In row	2.99 2.77 (LSD 5% = 0.13)	8%	None
Buckleboo SA 2005	Inter row In row	2.82 2.79 (NS)	None	None

Stubble management and inter row sowing

This year at Sandilands there was a significant interaction between sowing row and stubble management for yield and protein. "Standing inter row" was the stand out treatment with the highest yield and protein. "Slashed in row" was by far the lowest yielding treatment. The reason for this is unclear at this stage until further testing, but increased disease levels under stubble is one possible reason. "Slashed in row" also had higher screenings (4.5%) compared to all other treatments (1.5 to 2.5%).

Table 34: Third year wheat yields and protein at Sandilands 2005

Stubble	Sowing row	Yield t/ha	Protein %
Standing	Inter row	3.74	11.3
	In row	3.42	10.3
Burnt	Inter row	3.33	10.6
	In row	3.28	10.7
Slashed	Inter row	3.42	10.1
	In row	2.76	10.7
		LSD 5% = 0.31	LSD 5% = 0.58

In row nutrition

As stated before, wider row spacings (9" to 12") and knife points in no-till concentrate soil-borne pathogens in these stubble rows. It could be equally argued that nutrients e.g. P, become concentrated in the stubble row and next years crops should be planted on/next to this row to take advantage of this. Indeed, at Wakerie Colwell Phosphorus (P) levels in row (45 ppm) were higher than inter row (28 ppm). The effect of these differences in residual nutrition will be investigated over the next two years.

Future experiments

On-going research will explore other ways farmers may benefit from autosteer systems,

- Better canola establishment in heavy cereal stubbles.
- Increased lentil harvestability and yield from the trellising effect of standing stubble.
- Increased efficacy of soil applied herbicides e.g. Treflan, Dual.
- Differences in residual nutrition e.g. P, of inter row vs. in row sowing.

What accuracy do you need?

If you are serious about inter row sowing, a ±2 cm RTK system with your own base station is the way to go. This is because repeatable accuracy enables your sowing rig to come within ±2 cm of your sowing rows from the previous year and be able to hold a straight line down the length of the field. Sub-metre autosteer (±10-20 cm) does not have this level of repeatable accuracy, but you can re-set your A:B line by eye and attempt to inter row sow the following year. However, this will not be as successful as a ±2 cm system. Also, owners with sub-metre systems will allow for some overlap to compensate for the lower level of accuracy in the system. This results in an uneven row configuration across the field. From farmer experience, an estimated success rate for inter row sowing with various systems is as follows,

- Up to 90% for ±2 cm RTK system with your own base station.
- Up to 70% for sub-metre autosteer (±10-20 cm).
- Up to 50% by eye using permanent wheel tracks.

Some rules to follow for inter row sowing

- The base station **must** remain at the same location for a particular paddock year-in year-out.
- Your auto-steer **must** have the ability to store and recall an A:B line for a particular paddock.
- Your auto-steer **must** have a 'nudge' feature in order to move the required distance to go inter row e.g. nudge over 5" in year 2 if you are on 10" spacings.
- You **must** keep the same row spacing year-in year-out.
- It is preferable to sow in the same direction each year for each run because sowing rigs will crab, but hopefully crab in the same pattern as the previous year.

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Implementing and demonstrating innovative methods of stubble retention in high rainfall and irrigation cropping systems

Authors: Craig and Helen Reynolds

Contact No: 03 5828 8202

Key message:

- Stubbles need to be spread properly at harvest.
- Machinery has to be set up to sow accurately.
- Paddocks can get too wet for this system to work.

Aim:
Modify planting and harvesting equipment to enable accurate sowing in-between retained crop stubble rows.

Method:
Use of control traffic, autosteer equipment, alterations to existing planting equipment and addition of chopper and spreader to header.

Results:

Sowing system
The planting equipment was modified to accurately sow in-between the previous crop rows. The planting bar has multiplanter tynes and lift assist wheels. It follows the ground to control depth and plants on 25cm row spacing. Coulters were added to the planter to improve the accuracy of the sowing and cut through weeds and stubble, this has aided tracking and limited dirt throw.

The tractor was modified to work with precision guidance. An autofarm 2cm GPS system was fitted to the tractor and performs well.

A second precision planter was designed and built to sow corn in between the rows, using a primary sales nickels to sow fertiliser and a precision seed box to sow the seeds where they are wanted. This precision planter works well for summer cropping and integrates into the control traffic inter-row sowing system.

Harvesting system
The header had double spinners that worked well on dry stubble and chaff but didn't work well on greener plants, weeds and soybeans and spreading the required 36 feet was difficult. These were removed and a Redekop MAV (Massive Air Velocity) chopper was added. This has straight blades (requiring less horsepower) and paddles that make wind on the ends, where the stubble needs to get thrown the furthest. These modifications have worked well and chaff and stubble is now managed without the need for burning.

The header fits into the 3 meter control traffic system and does not run over stubbles, an important factor for later sowing passes.

Observations and comments:
The equipment set-up still needs some work, particularly the machinery's capacity to work wet soil.

Sponsors:
Federal Government National Landcare Program (NLP) Natural Resource Innovations Grant.

The Potential for Growth in the Feed Grain Market in Australia

Author: Ingrid Richardson

Contact No: 02 8233 8446

Organisation: Rabobank Food & Agribusiness Research

Key message:
- A growing feed grain industry potentially provides an alternative market for east coast growers.

The story common to mature markets is one of flat or declining demand, stable supply and, often, declining prices. Not often is a mature industry, like the Australian grain industry, presented with a significant opportunity and growing source of demand. However, in recent years, the growth in demand for feed grains has emerged (Figure 26).

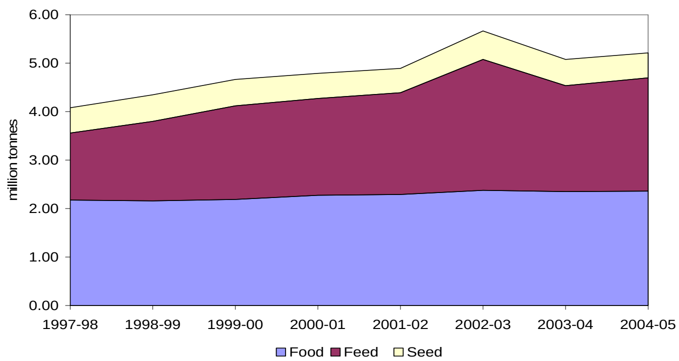

Figure 26. Wheat use in Australia: food, feed and seed, 1997/98-2004/05

Source: ABARE, Australian Commodity Statistics, 2005

Australia is still a developing market both in terms of feed consumption and production. This is understandable considering that with limited demand in the past, there has been little incentive, until recently, to expand feed production.

Feed Grain Demand

The largest user of feed in Australia is the east coast based cattle feedlot sector with the turnoff of cattle on feed in Australia reaching a record of 2.6 million head in 2005. Today, approximately 30% of all cattle slaughtered in Australia are finished on grain and the feedlot sector has grown steadily over the last decade. In addition, supplementary feeding in the dairy industry has grown considerably in recent years, as the industry intensifies following deregulation. The dairy industry now consumes around two million tonnes of feed per year, up from very little a decade ago. Lastly, the pork industry is driven by both growing domestic consumption and increasing export sales.

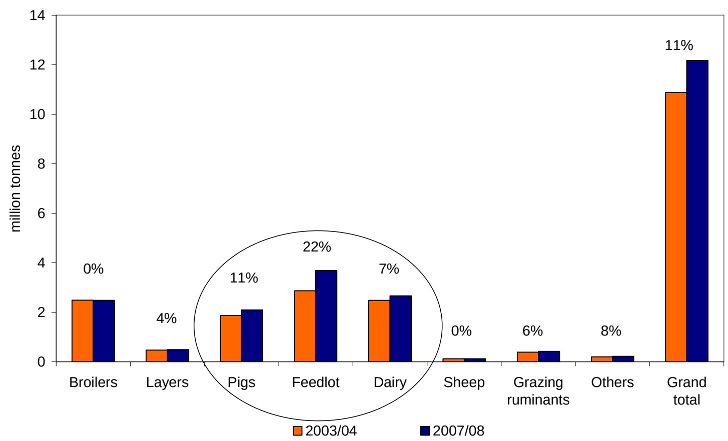

Figure 27. Feed grain demand projections, 2003/04 – 2007/08

Source: Feed grains: future supply and demand in Australia, 2003, ABARE

All the evidence leads to the simple conclusion that feed grain demand is going to grow, and, it is going to grow significantly. This growth is likely to be particularly focussed on the east coast of Australia where these animal industries are located. Keeping pace with this demand presents a unique opportunity for the grain sector.

Feed Grain Supply

The production of both feed and food grains has increased substantially over time in Australia, with growth occurring as a result of productivity gains and area expansion. Coarse grain production has grown at a compound annual growth rate of 6% over the last ten years while wheat has grown at a rate of 9% over the same period.

Further growth in feed grain supply will come, as in the past, through continued increases in productivity. While any future increases in area devoted to feed grains will depend upon the price signals growers receive: if feed grains perform financially on a returns per hectare basis, then they will be planted, at the expense of other crops or livestock. The price of feed grain will always be the sticking point for both participants in the supply chain – grain growers and end users. Grain growers require a price incentive to devote time, money and area to a feed grain crop at the expense of other crops which generally show a higher return on a per tonne basis. However, from the perspective of a feed grain user, where grain is a significant input cost, higher prices lead to lower margins. This relationship becomes a catch-22: without significantly higher yields per hectare for feed grains (compared to food grains) and thus, financial returns, there will continue to be volatility of supply. For this reason, investment into research and development to improve the return per hectare of feed grains is essential to reduce the volatility of supply in the long term.

Conclusions:

For east coast grain growers, the feed grain industry should, potentially, provide an alternative to more traditional marketing channels. And, in the longer term, it could act as a new speciality market. In the future, the feed market is unlikely to demand generic grain, but rather will be looking for specific products to suit animals at different stages of development, and to produce different results. Be it domestic or export, the specificity and traceability of grain is only going to increase.

Growth in demand for feed in Australia seems highly likely. The other likelihood is that this growth in demand will be focussed on the east coast of Australia. Global and local indicators suggest that animal protein and dairy commodity markets will enjoy solid growth prospects in coming years. For the Australian grain sector, there is a unique opportunity to develop a market which has been perceived as a secondary market. Developing this domestic market has similarities with the development Australia has undertaken in overseas market: it requires cooperation between the grain marketing sector and the customer in order to develop and consistently produce the most appropriate grain - whether this customer is an animal or a human consumer is largely irrelevant.

Sponsors:
Rabobank Food & Agribusiness Research

SWAP versus Forward Sale Field Study 2005

Authors: Brett Stevenson

Contact No: 02 9440 1500

Company: Market Check

Key message:

- Using NAB Grain SWAPs to manage wheat price risk is lower risk and generates higher returns than using forward contracts.

Aim:
Test the performance of NAB Wheat SWAPs versus Forward Contracts by tracking the returns from using SWAPs and forward contracts to lock in prices for wheat during the 2005 growing season for a medium scale cropping enterprise in South Western NSW.

Method:
Assume a SWAP was entered into the same day as a forward sale was made and wait until harvest to assume delivery against the forward sale or sale of the grain and settlement of the SWAP. Measure the financial difference between the alternative techniques to manage price risk of the grain.

Hedge One - 21st April 2005:
200 tonnes of wheat was forward sold at $154.75 per tonne on a delivered Port basis.
200 tonnes of NAB CBOT March 2006 Wheat SWAP at $170.50 per tonne.

After sowing rain was received in mid June 2005.
Hedge Two - 11th August 2005:
200 tonnes of wheat was forward sold at $155.75 per tonne on a delivered Port basis.
200 tonnes of NAB CBOT March 2006 Wheat SWAP at $165.55 per tonne.

Results:
Harvest commenced on 12th December 2005 and cash prices available at that time were used for cash sales against the settlement of SWAPs. 400 tonnes of APW delivered to Oaklands Graincorp was used as delivery against the forward sale or cash sale against the SWAP.

Hedge One:
Forward Sale:
200t delivered against the contract creating cash return $154.75 per tonne less NACMA freight differential $27.09. Net Silo $127.66t
NAB SWAP:
Initial SWAP $170.50t less Settlement price $147.80t (i.e. price SWAP was bought back from NAB on day grain was sold) equals $22.70t (credit from NAB)
Cash sale of grain $124.91t
Net return from SWAP $147.61t ($22.70 + $124.91)

Return from Forward sale $127.66 per tonne
Return from NAB SWAP $147.61 per tonne
NAB SWAP premium $19.95 per tonne

Hedge Two:
Forward Sale:
200t delivered against the contract creating cash return $155.75 per tonne less NACMA freight differential $27.09. Net Silo $128.66t
NAB SWAP:
Initial SWAP $165.55t less Settlement price $147.80t (i.e. price SWAP was bought back from NAB on day grain was sold) equals $17.75t (credit from NAB)
Cash sale of grain $124.91t
Net return from SWAP $142.66t ($17.75 + $124.91)

Return from Forward sale $128.66 per tonne
Return from NAB SWAP $142.66 per tonne
NAB SWAP premium $14.00 per tonne

Observations and Comments:

1. Hedge one was taken at a time of year when seasonally forward prices are commonly higher than harvest prices. The normal seasonal break did not arrive until mid June requiring consideration of crop failure. Had the crop failed it would have been a great deal more difficult to cancel the forward contract compared to the ability to buy back the SWAP with the bank. Also the prices with Australia increased significantly by mid June due to dry conditions meaning that if the forward contract was able to be washed out the resulting loss would have been significantly higher than the loss on the SWAP.

   The liquidity provided for the SWAP and reliance on international prices rather than domestic Australian prices creates a significantly lower washout risk than the forward sale.

2. On this farm a proportion of the harvest was HPS1. Had this been the only quality produced or if there was some other quality issue the grain could have been undeliverable to the tolerances of the forward contract. Conversely the SWAP is balanced by a forward sale of grain. The SWAP is independent of this sale and therefore there is no quality performance risk associated with the SWAP.

Sponsors:
NAB Agribusiness Albury, and
AgRisk Management Pty Ltd.

Insert NAB Full Page Ad

The availability of Phosphorus from cattle manure on a Riverine Soil

Authors: Ben Kerslake and Ken Young

Contact No: 03 5833 9251

Organisation: University of Melbourne, Dookie Campus

Location: Laboratory
Replicates: 3

Key messages:
- 50t/ha rates of cattle (feedlot) manure can provide enough P nutrition for annual cropping.
- Higher rates of cattle manure above 50t/ha could cause an increase in exchangeable sodium percentage in the soil.

Aim:
To assess the amount of available phosphorus from cattle manure.

Method:
Soil and feedlot stockpiled manure were mixed at rates equal to 50, 100 and 200 t/ha of manure. These pots were then left to incubate for 4 weeks and were watered to maintain 70% field capacity.

After 4 weeks incubation, 36 sub samples were taken from each pot. For each set of nine sub samples either 0, 50, 100 or 250mg P/kg was added. These were then put on a shaker for 0, 7.5, 15, 30, 60, 120, 240, 480 or 960mins. At their respective time, the sub samples were removed from the shaker and centrifuged and the supernatant was extracted and p-nitrophenol added. These were then assessed for colour into spectrometer for available P. The spectrometer reading was assessed against known standards.

Results:
Although the higher manure rates had an increase in total P available, the actual % P recovered was lower than the 50 t/ha rate (Table 35) the other disadvantage of the higher rate is the increase in Na levels and the decrease in the Ca/Mg ration (Table 36).

Table 35: The amount of P added in manure and the amount of P recovered after 4 weeks incubation

Manure Rate t/ha	P added kg/ha	Recovery kg/ha	%
50	47.5	15.7	33.0
100	95.0	29.8	31.0
200	180.0	21.5	11.9

Table 36: Total cations, ESP, Ca/Mg, Al%, EC & pH for each manure rate after 4 weeks incubation

	Manure Rate			
	0 t/ha	**50 t/ha**	**100 t/ha**	**200 t/ha**
Total Cations	1.09	14.91	18.92	23.58
ESP %	0.3	3.78	5.81	8.64
Ca/Mg	3.55	2.37	1.88	1.60
Al %	0.17	0.09	0.05	0.01
EC	0.08	0.46	0.84	1.33
pH	5.52	5.91	6.21	6.61

Acknowledgements:
Dr Tim Clune, Department of Primary Industries, Victoria, Rutherglen.

Yield improvements associated with Controlled Traffic

Authors: Nathan Sydes and Ken Young

Contact No: 03 5833 9251

Organisation: University of Melbourne, Dookie Campus

Key message:

- Controlled traffic allows better management of farm operations which leads to increased yields and WUE.

Aim:
To assess if the adoption of controlled traffic farming has increased yields.

Method:
Yield data were collected from several dryland farms around the Dookie district that had adopted some form of controlled traffic.

From the available data, season pre controlled traffic and post controlled traffic were matched on GSR, but also the rainfall for the periods March to April; May to August and September to October. Only two sets of comparable years were available to investigate. Results from 2000 were matched with 2003 and 1997 with 2004. Yields were compared using Fishers t-test.

Results:
In both comparisons on farm 1, there was an increase in yield associated with the adoption of CTF. In the 2000 vs. 2003 this was an increase of 1.58 t/ha, there was however an extra 50mm of rainfall during the May to August period so the potential increase in yield was already 1 t/ha (based on WUE of 20 kg/mm/ha) so there still was an overall increase of 0.5 t/ha. In 1997 vs. 2004 the increase was 1.55 t/ha with very similar rainfall for each sector of the growing season. From farm 2 a similar trend existed but the differences were not as great. These were 0.42 t/ha and 0.71 t/ha increases due to CTF in 2003 and 2004 respectively. Water use efficiency was increased under CTF in poorer season i.e. 1997 vs. 2004, suggesting that CTF may not only improve overall yields in general years but improve margins in tight years.

Table 37: The comparisons of conventional race track and controlled traffic operations. Years showing rainfall, grain yield and Water Use Efficiency

		2000	vs.	2003	1997	vs.	2004
Type of Traffic		RT		CTF	RT		CTF
Rainfall (mm)	March - April	51.6		40.6	19.0		18.4
	May - August	258.0		309.9	181.0		186.4
	Sept - October	113.8		101.2	79.6		74.8
Growing Season Rainfall (mm)		404.6		450.3	267.2		275.0
GSR + Stored Water (mm)		417.3		465.1	270.8		275.0
Potential Grain Yield (t/ha)		6.15		7.12	3.22		3.30
Farm 1							
	Yield t/ha	5.62		7.20	2.99		4.54
	t-test (prob)		<0.01			0.03	
Water Use Efficiency							
	WUE (kg/ha/mm)	18.41		19.75	17.81		27.50
	t-test (prob)		0.16			0.03	
Farm 2							
	Yield t/ha	4.38		4.80	2.99		3.70
	t-test (prob)		0.04			0.15	
Water Use Efficiency							
	WUE (kg/ha/mm)	14.33		13.17	19.43		22.42
	t-test (prob)		0.05			0.06	

Acknowledgements:
We would like to thank the growers who kindly assisted us by freely giving their time and data.

Efficacy of fungicidal seed and fertiliser treatments

Authors: Seamus McKinley and Ken Young

Contact No: 03 5833 9251

Organisation: University of Melbourne, Dookie Campus

Location: Dookie College
Growing Season Rainfall:
Annual: 550 mm
GSR: 350 mm
Sowing Information:
Sowing date: 2/8/2005
Fertiliser: 80 kg DAP
Row Spacing: 17.8
Paddock History:
2005 – Wheat
2004 – Wheat
Plot Size: 1.4 x 20m
Replicates: 4

Key message:

- Jockey and Real had the highest seedling emergence rates, yields, and with the lowest disease incidence and grain impurities which suggest these treatments provide greater potential then other treatments tested in this trial.

Aim:
To assess a range of seed dressings for disease management.

Method:
A range of seed dressings were applied to Yitpi wheat, an untreated H45 and H45 treated with Real were also included as treatments. Plots were assessed from emergence and plant establishment as well as for disease incidence and disease score. The plots were harvested on 30 December 2005 and assessed for yield and grain quality.

Results:

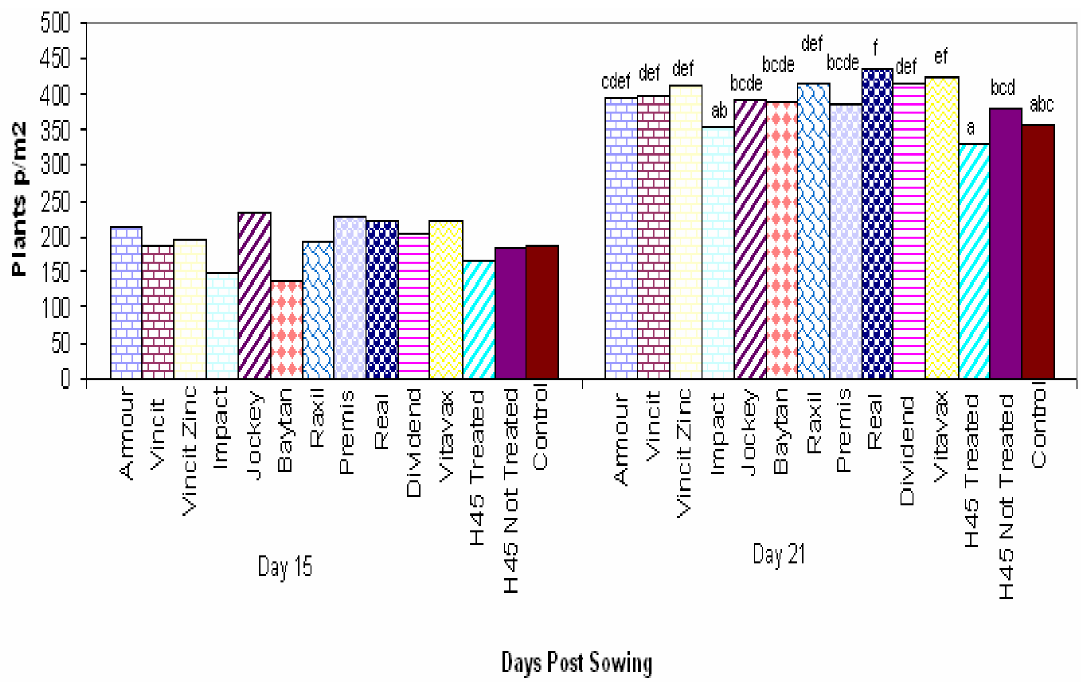

Figure 28. Emergence numbers (plant per m^2), 15 and 21 days post sowing, columns with same letter do not differ significantly according to Fishers protected LSD (p = 0.053)

Emergence was affected by seed dressing with H45 Treated (H45T), having lower emergence rates (Figure 28) control and impact also expressed low emergence but were not significantly different from H45T. The treatment of Real expressed a significantly higher emergence (435 plants/m^2). The treatments Armour, Vincit, Vincit Zinc, Raxil, Dividend and Vitavax also expressed higher emergence.

Disease management was effective in most treatments apart from the untreated control, Impact, H45 treated and H45 untreated. Yield results were the inverse of the disease levels, with low disease levels obtaining highest yields (Figure 30). The exception to this was the untreated control of Yitpi which yielded better than most treatments.

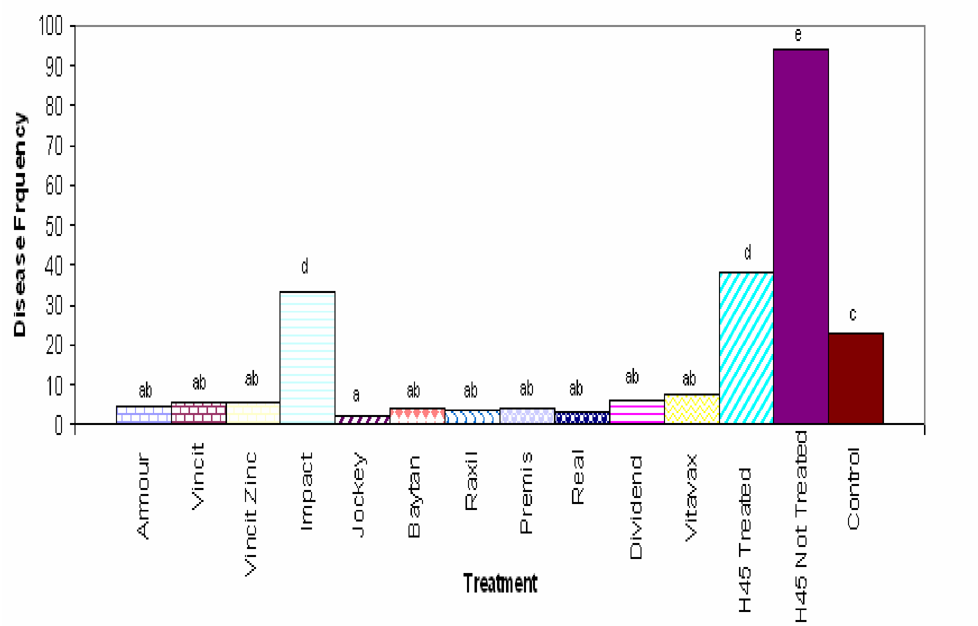

Figure 29. Disease Assessment percentage stripe rust infected leaves when crop was at Z- 43 stage, columns with same letter do not differ significantly according to Fishers protected LSD (p- 0.05)

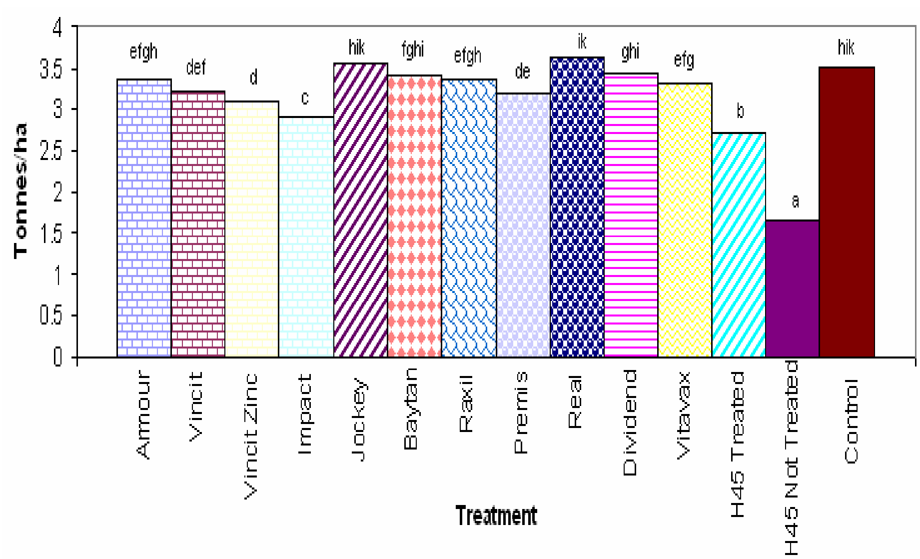

Figure 30. Treatment yields in tonnes per/hectare (t/ha), columns with same letter do not differ significantly according to Fishers protected LSD (p- 0.05)

Sponsors:
Independent Associated Seed Graders.

Zoning paddocks for Lime and Gypsum

Author: Ken Young

Contact No: 03 5833 9251

Organisation: University of Melbourne, Dookie Campus

Location: Dookie College
Growing Season Rainfall:
Annual: 550 mm
GSR: 350 mm
Soil:
Type: Silty Loam
pH (H_20): 4.60
Sowing Information:
Sowing date: 15/6/2005
Fertiliser: 75 kg/ha DAP
120 kg/ha urea
Row Spacing:
Paddock History:
2005 – Canola
2004 – Barley
2003 – Wheat
Plot Size: 6 x 50 m
Replicates: 5

Key message:

- Zoning of the paddock gave a cost reduction in lime and gypsum management.

Aim:

To assess the effect of zoning a paddock for the application of lime and gypsum.

Method:

The paddock was EM38 surveyed, and a zonal map was produced by Peter Baines. From this map three areas were selected to either apply the zonal rate or the straight paddock rate 1t/ha gypsum and no lime (Figure 31).

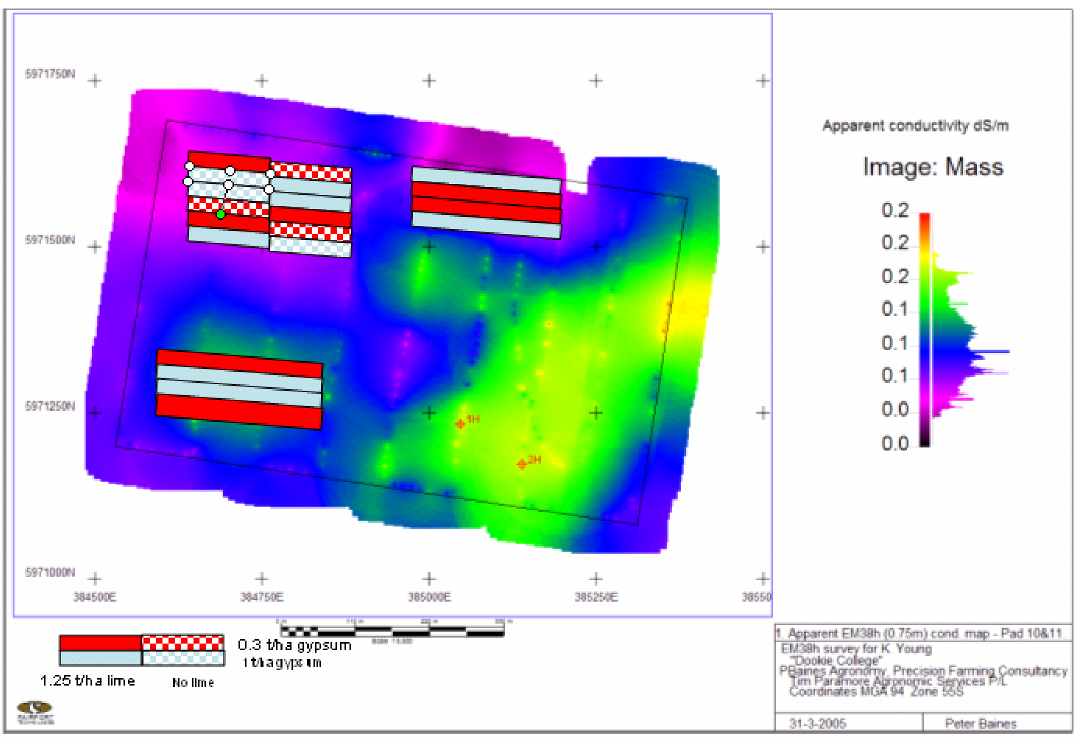

Figure 31. EM38 survey with treatment design, with gypsum applied at either 0.3 or 1.0 t/ha and lime either 0 or 1.25 t/ha

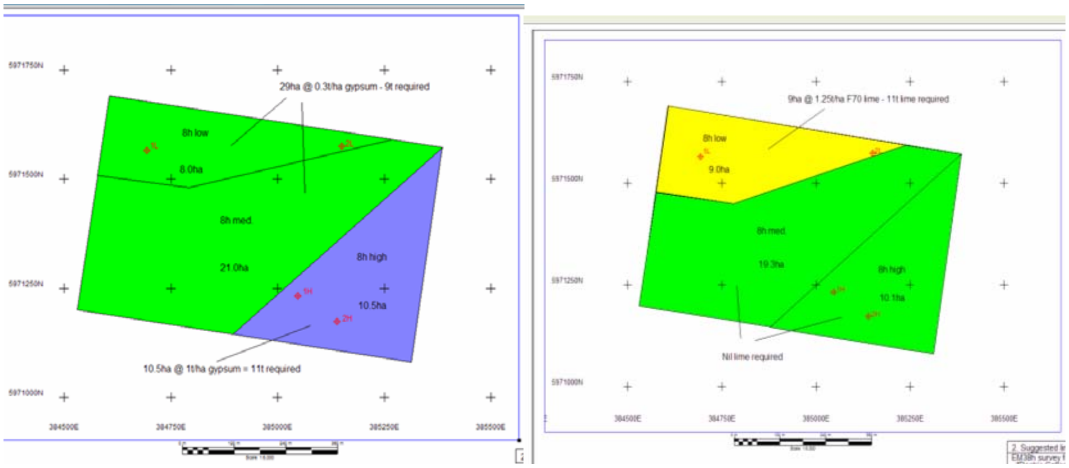

Figure 32. Zonal management for gypsum and lime

Results:

There was no significant difference by adding extra gypsum or lime (Table 38). A regression analysis of yield against the EM reading showed a weak correlation with increasing yields to increase EM reading (Figure 33) suggesting that lower EM values the soil type had less CEC as backed up by the associated soil cores (CEC levels 15.1 meq/100g for the high areas and 7.4 meq/100g for the low areas. Another possibility was the water holding capacity of the two soil types, with the high readings associated with a Congupna clay and the low reading with and a Nalinga loam.

Table 38: The effect of treatment on Canola yield

Treatment	Yield (t/ha)
0.3 Gypsum & no lime	1.50
1.0 gypsum & no lime	1.46
0.3 gypsum & 1.25 lime	1.27
1.0 gypsum & 1.25 lime	1.30

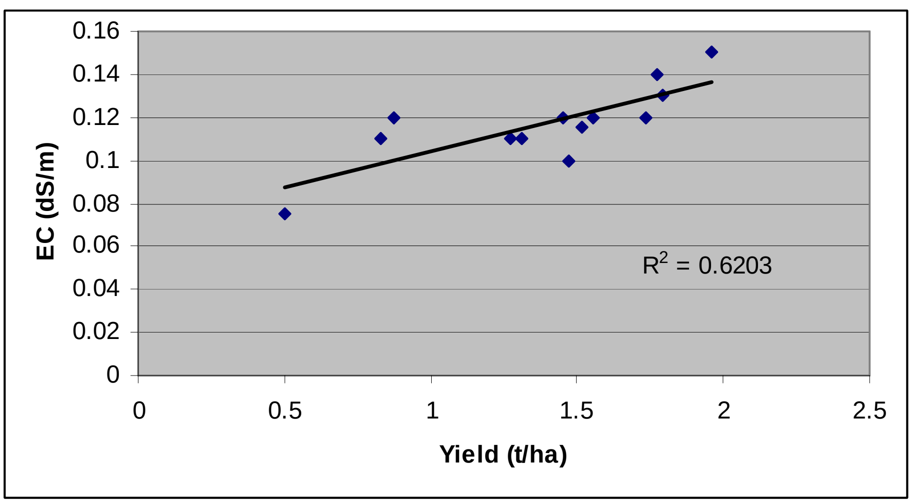

Figure 33. Regression of yield against EM readings (estimated dS/m^2)

The Effect of Biosolid Application on Soil Biological Fertility

Authors: Madaline Healey and Cathy Botta

Contact No: 03 5833 9251

Organisation: University of Melbourne, Dookie Campus

Growing Season Rainfall:
Annual: 550 mm
GSR: 350 mm
Soil:
Type: Clay loam
Paddock History:
2005 – Kaspa peas
2004 – Whistler wheat
Plot Size: 20 x 100m
Replicates: four

Key message:

- Biosolid application to a cropping soil does have a significant effect on microbial biomass and bacterial population.

Aim:
The objective of this trial was to measure the effect biosolids have on the soil pH, organic carbon % and bacterial population of a cropping soil.

Method:
Bacteria population was measured using a BIOLOG eco-platter, to determine the number of bacteria within each soil sample. Biosolid application was applied in 2003 and 2004 and included five treatments at 0, 20, 30, 40 and 50t/ha.

Results:
Two years after biosolid application there was no significant effect on organic carbon %. However biosolid application did increase soil pH ($CaCl_2$), and bacterial numbers (Figure 34). Bacterial numbers were most significant at the application rate of 20 t/ha. Whether this was due to being the ideal pH for the bacteria was not determined. As pH increased there was a significant drop in the number of bacteria, then a rise when application rates increased to 50 t/ha. More detailed experiments are required to identify the range of bacteria and if they had changed between treatments.

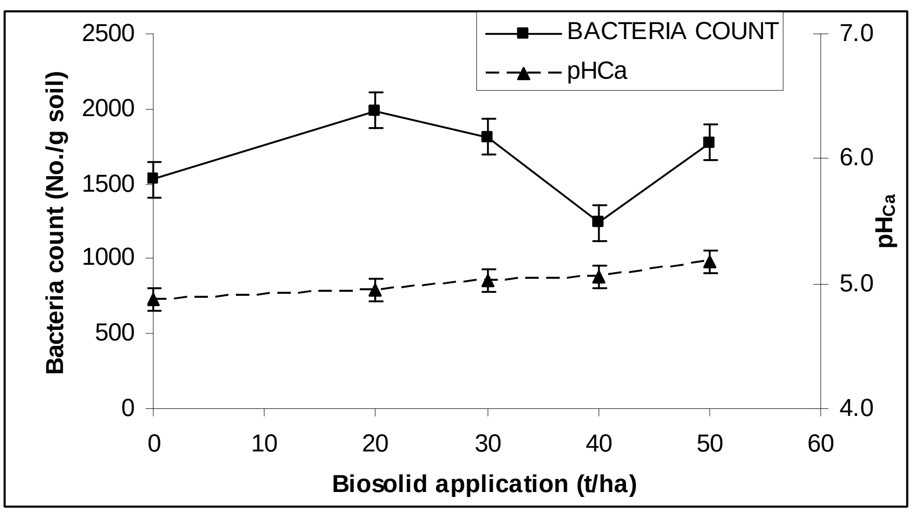

Figure 34. The effect of biosolid application on pH ($CaCl_2$) and number of bacteria per g of soil

Acknowledgements:
Thanks to Pauline Mele and colleagues at DPI Victoria, Rutherglen for their assistance in microbe identification.