Research for the

Riverine Plains 2009

Farmers promoting excellence in farming systems by providing quality information, leading research and sharing ideas for the economic, environmental and social benefit of the Riverine Plains.

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Acknowledgements

Welcome to the 2009 edition of the Riverine Plains trial book. The first thing you'll notice (apart from the colour printing and snazzy new layout) is that this year's book is out much earlier that it has been over the past few years! By publishing the results prior to the start of the sowing season, we hope you'll gain much more value from the research presented within.

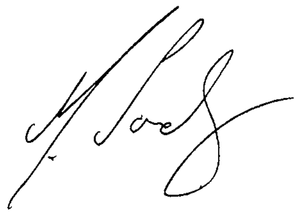
While 2008 was yet another exceptionally tough one, there was lots of valuable research conducted across our region — and it's this research that is helping us form some best bet strategies for managing in these times of extreme rainfall variability.

This year we have our usual array of articles, from reports on variety trials and fertiliser strategies to best bet rotations, precision agriculture and more efficient agronomic practices. We hope you find the local perspectives valuable and that the articles provide you with insight to some of the more pressing questions raised by the recent run of dry seasons.

On behalf of Riverine Plains Inc, I'd like to once again thank all those that submitted articles for this years' trial book. We sincerely appreciate all the contributions from our sponsors, research organisations and industry bodies. Once again, the Victorian and NSW Departments of Primary Industries have both made significant contributions to the trial book with their reports on locally run trials. John Sykes from John Sykes Rural Consulting has continued his collaborative work with Riverine Plains Inc and the Grains Research and Development Corporation and his reports present the key findings from this valuable work.

Special thanks also need to go to Fiona Hart for sourcing the articles for the trial book and for liaising with the Kondinin Group, who prepared the book for publishing.

We hope you find the information contained in the trial book both timely and relevant and wish you all the best for the 2009 cropping season — may it rain on your patch of dirt!



Michelle Pardy

Editor

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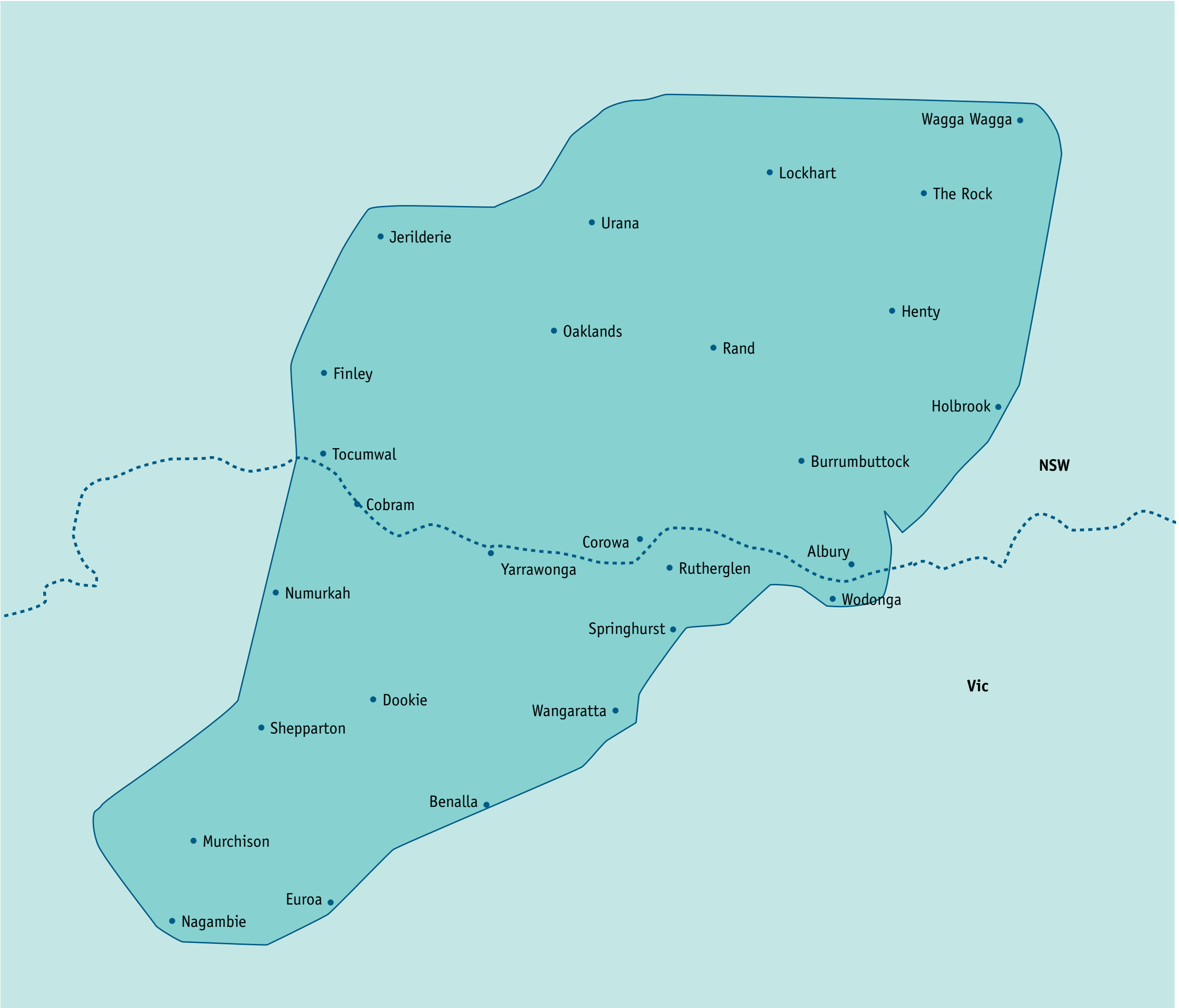
Area covered by Riverine Plains Inc

Membership area



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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 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 averaged 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 (sum of 4 plots then divided by 4) of each variety accounts for variations in soil type.

Statistical tests for example, 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 the mark NS (meaning 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 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.

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

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 then be statistically validated. For example, it may be that one variety was favoured by being sown on the better half of the paddock. We can talk about trends within a demonstration but cannot say that results are significant. 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

During recent weeks, Riverine Plains' membership has exceeded 300 businesses for the first time. This is an exciting milestone, made all the more significant by the fact it has come on the back of the third severe drought year in a row. And this alludes to my highlight for the past year…

During the past year, Riverine Plains has done its usual stuff. The 2008 GRDC Farmer Update had near record attendees, and the Winter Update wasn't far behind. There was another successful bus trip, this time to central New South Wales, and two spring field days were held and well attended in spite of another non-existent 'spring'.

We have seen the virtual completion of the GRDC project *Improved winter cropping systems in the Riverine Plains*. Known locally as the 'third crop' project, which refers to the aim of developing best management packages for crops grown on a wheat stubble, and/or the 'PA project', the combined efforts have had the misfortune of being undertaken during one of the worst droughts on record. However, it has been great to see some important results come out of the project that will make a difference to the way we farm.

Riverine Plains also ran a number of 'ride and drive' or 'come and look' days during the year. All were extremely well attended with 120 farmers at the seeder day during June, and a combined 130 farmers at the two guidance/ autosteer days during October. The enthusiasm for these events, on top of the outstanding attendance at our usual events, leads me to spell it out…

The highlight for me from 2008 has been the unwavering enthusiasm of our local agricultural community to continue to improve their farming systems even in the face of such difficult circumstances. It makes sense of course. The fewer resources we have to apply to our systems, or the greater pressure for a positive result, the more important it is to get it right. But nonetheless, maintaining enthusiasm in the current cycle is not the easiest thing in the world, and all those who have achieved this deserve to be congratulated.

For Riverine Plains, the past 12 months have been about the continued steady growth that has characterised the group since its inception during 1999. This style of growth has proven to be sustainable and robust, and provides us with a strong foundation on which to continue to build a service to our members and the general agricultural community.

The major challenge for the group moving forward into the next 12 months and beyond is to make the most of the opportunities that present themselves, while operating within the constraints of our resources and staying true to our core values. Like farming systems, Riverine Plains will meet this challenge by evaluating, analysing and innovating.

During 2008, we instigated an 'advanced PA group' — Riverine Plains recognises the early adopters of PA want to keep moving forward by learning about more sophisticated systems they could adopt, while at the same time the need for a 'general PA discussion group' remains. The 'advanced group' was designed to not only help its members, but extend its finding to others and work with the wider industry with regard to the services it will need to offer upon large-scale adoption of site-specific strategies.

During 2009, the trial book you are now reading has changed. We have recognised that while it is nice to produce a publication each year, large enough to be a coffee table show piece, the extension achieved through this is not the best we can do. So, we present to you a more targeted and more timely trial book.

The resources saved by the above change will be reallocated into the introduction of a Technical Bulletin that will be delivered regularly by email and/or fax during the growing season to give you a heads-up on the latest issues at the time. Also, the newsletter will grow, offering keynote articles in each edition as further items of interest come to hand.

Also, during 2009, the first trials of our new GRDC-funded project aiming to improve water-use efficiency of farms in the area by 10 per cent will be laid down. This project will see Riverine Plains building on its previous successes in precision agriculture and canopy management in new areas. Specifically, no-till stubble retained systems, and the latest on ground-based crop sensing technology.

Riverine Plains continues to be the most exciting community group I am involved in, and for this there are many to thank. Our sponsors, who have not only maintained their enthusiasm for the group during such a long period, but in the face of the global financial crisis, have committed to significantly increasing their financial contributions for the coming year. Fiona Hart continues to admirably 'put up' with the committee with enthusiasm and diligence and efficiently deals with an evergrowing workload. The committee, which continues to be a source of enthusiasm and grassroots commitment, is an absolute pleasure, and lastly the members of Riverine Plains in general who have stayed the course with us through such a difficult period.

Two words to sign off with — GOOD LUCK!

Adam Inchbold.

2008 — the year in review

Seasonal summary

Janet Walker NSW DPI, Albury

Following the previous dry spring during 2007, the year started wet with good summer rain. This was followed by a relatively dry autumn and while there was sowing rain at the end of April it was not enough to get all crops in, with sowing continuing with minimal moisture into June. However, the continued warm conditions into late autumn allowed late sown crops to establish well.

Good rain during July and August was followed, again, by one of the driest springs on record. Growth of winter grazing cereals was slow despite the warm conditions, because of the lack of moisture. The later break and tough autumn meant many crops did not set a high yield potential and had less vegetative growth.

Monthly maximum temperatures for early autumn, early winter and spring were above average (see Figure 1). The warm conditions continued until late May — this led to fewer frosts during late autumn and early winter. Some late frosts did occur during August and September (see Figure 2). Minimum temperatures during September were below average, as is typical of drought years.

Rain towards the end of the season improved rainfall figures despite the dry spring. Total rainfall for the year was in decile one and two (see Figures 5 and 6) with 481.8 millimetres and 466.6mm for Albury and Corowa respectively (see Figures 3 and 4). The cumulative growing season rainfall for Albury and Corowa, similar to the annual rainfall, was decile one and two respectively (see Figures 7 and 8).

Cropping review

Early crop growth was slow despite the warm conditions. The lack of moisture also resulted in slow growth of grazing cereals. Most cereals were only grazed once and not until late June or July. With the good summer rain and a warm autumn, high numbers of cockchafers in many paddocks caused significant seedling death in some areas. The lack of May and June rain reduced vegetative growth and yield potential.

The lower yield potential meant many cereal crops hung on well, despite the lack of spring rain. The less bulky crops, with lower yield potential also made it less economical to make hay from cereals. While few cereal crops were cut for hay, a number of canola crops were cut for hay or silage early during spring. This proved to be a sound decision, as dry conditions continued and canola crops struggled to finish.

Stripe rust was an issue, despite the dry season. The rust epidemic started early with the first infected crop found during late June. This was likely due to the number of susceptible volunteers growing during summer to carry the rust through to early sown susceptible grazing cereals. The new Jackie stripe rust caused most problems with many triticale crops having

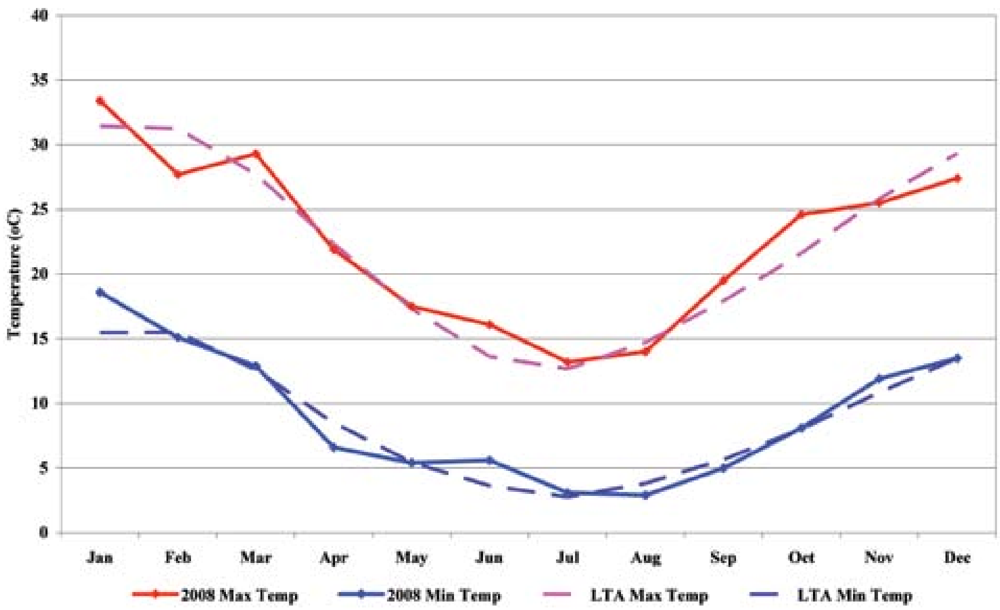

FIGURE 1 Minimum and maximum temperatures for 2008, compared with long-term averages (LTA)

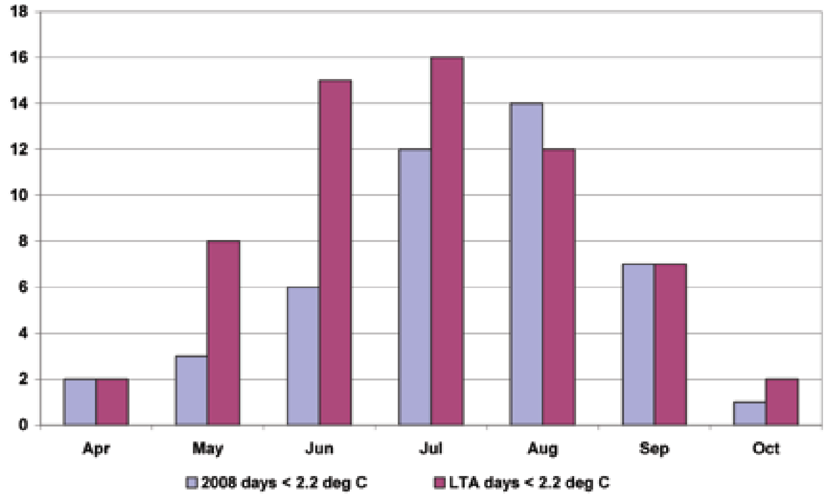

FIGURE 2 Frosts in Albury 2008 compared with long-term averages (LTA)

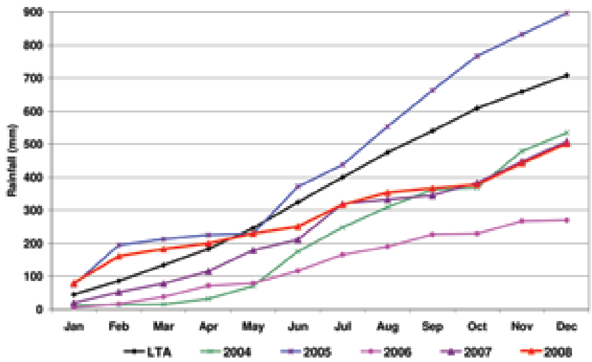

FIGURE 3 Cumulative rainfall Albury

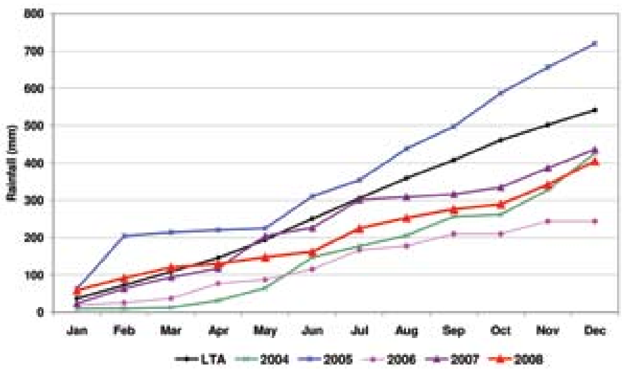

FIGURE 4 Cumulative rainfall Corowa

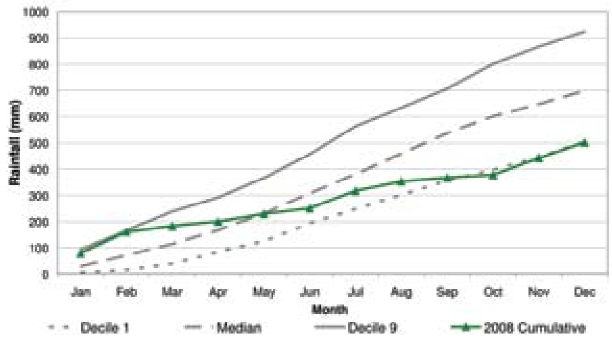

FIGURE 5 Cumulative rainfall at Albury 2008 against decile 1, median and decile 9

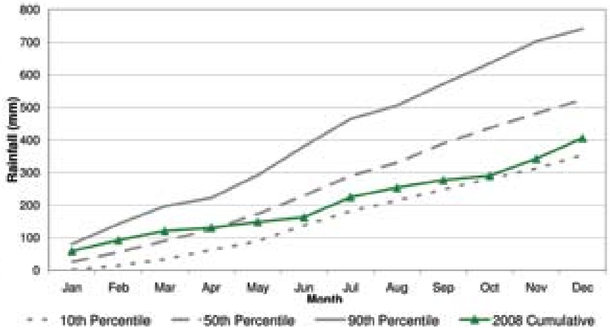

FIGURE 6 Cumulative rainfall at Corowa 2008 against 10th, 50th and 90th percentile

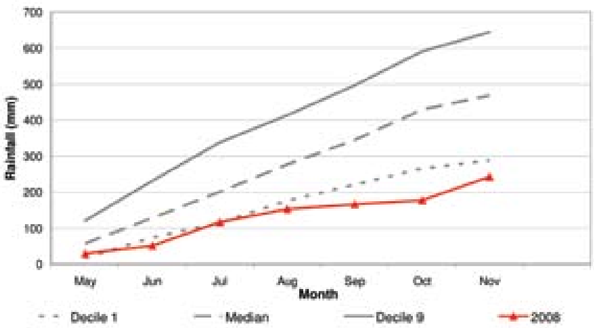

FIGURE 7 Cumulative growing season rainfall at Albury 2008 against decile 1, median and decile 9

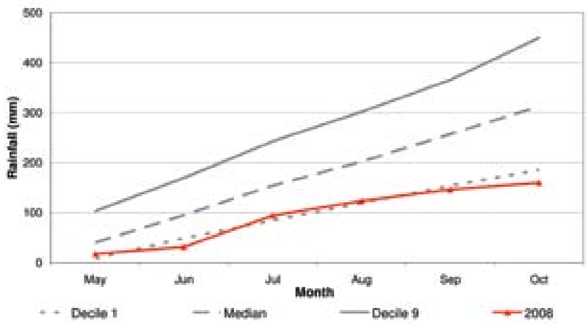

FIGURE 8 Cumulative growing season rainfall at Corowa 2008 against decile 1, median and decile 9

heavy early infection. Most triticale crops were sprayed at least once with some three times. Another new pathotype was also discovered, which will infect some newer wheat varieties.

Aphids were a major problem in canola with the dry spring. The low yield potential of many crops made the decision to spray difficult, with some aerial spraying and perimeter spraying continuing late in to the spring. Heliothus were also a problem for canola late in the season. Again, with most crops, it was uneconomical to spray given the poor yield potential.

Despite the lack of spring rain, there was less frost damage than previous dry years. Cereals were generally unaffected, although there was frost damage in some canola crops.

Yield results

Crop yields varied across the district and also from paddock to paddock. Where summer weeds were controlled, conserved soil moisture was important and crops performed better.

Contrary to previous droughts, early sown cereals yielded better than late sown, quicker maturing varieties. This was due to strong early root development making use of stored summer moisture. Early sown cereals, even those sown outside the sowing window, yielded higher than late sown cereals, which ran out of moisture at grain filling.

Late rain only benefited long-season wheat and triticale varieties on the eastern side of the district. However, for most of the district the late rain was too late, seeing some yields lower than during 2007, where the late rain came in time to benefit more crops.

Crop yields in the western areas towards Corowa were low, while some crops on the eastern side of the district yielded 2.5–3 tonnes per hectare. Cereals to the west of Corowa yielded 0.8–1.5t/ha depending on summer rainfall and variety.

As harvest moved further east, yields rose to 1.6–2.2t/ha. Some crops on the far eastern side around Holbrook yielded 3–4t/ha, however this varied greatly depending on timing of rain to maturity of the variety.

Barley crops, being quicker to mature, yielded better than other cereals but again suffered from high screenings. Some other cereals had high screenings and problems with small seed for sowing this season.

While less than half of the district canola was cut for hay the remaining crop yields were very low— most under 1t/ha. Many canola crops in the western parts of the district yielded less than 0.5t/ha and some did not warrant harvesting. Oil content was also low with the average around 35%.

Lupin and pea crops generally returned low yields of less than 1 t/ha.

Pasture production

There was strong pasture/weed growth during summer, which kept stock going without reliance on supplementary feeding. Lucerne pastures also proved valuable during this period. However, the dry autumn prevented growth of perennial phalaris/sub-clover pastures leading to little available feed going into winter.

Despite good moisture conditions during winter, growth was slow with cooler conditions. The following dry spring produced little growth with winter moisture soon depleted. This meant little hay or silage was made during spring, as most forage was needed for grazing.

The later autumn break and little early growth did not favour clover, which already had low seed levels following previous droughts. Competition during spring from annual weedy grasses, such as barley grass and vulpia meant these species dominated during spring and set seed under the dry conditions.

By harvest most producers were waiting on stubble to keep stock going, with little pasture feed available. Despite some reprieve with rain in November and December there was little growth left to keep stock going during summer.

Dry conditions resulted in hand feeding towards the end of summer. With few crops cut for hay or silage, most feed was hay left from 2007 crops used to keep stock through the drier months.

The dry conditions also affected stock water supplies, with creek and dams drying out. For some the solution will be to sell stock or look for alternate water supply options.

Newly established perennial pastures and lucerne struggled to establish and many died out before the late rain, failing for the third year in a row. Many perennial pastures now have poor plant stands especially sub-clover seed reserves. There is also a major challenge with grass weeds. Over-sowing with supplementary clover seed in some paddocks or returning paddocks to the cropping programme for re-establishment could be the best option.

Note: The details of this report are based on the NSW DPI Albury agronomy district. The weather data in the report is sourced from Silo weather data.

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Optimise efficiency and economics with variable rate applications

Photo: Kondinin Group

Efficiency: Better understanding of in-paddock variations could see producers increase the efficiency of fertiliser applications through variable rate technology.

WRITTEN BY
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Adam Inchbold Riverine Plains Inc

Recent research results indicate that a better understanding of in-paddock variation could allow growers to take advantage of variable rate technology (VRT) in the application of phosphorus (P), nitrogen (N), lime and gypsum.

KEY POINTS

- Different zones in the same paddock frequently have different responses to applied phosphorus (P).
- Treating whole paddocks with an average rate of phosphorus can results in wastage through over fertilising, and potentially, under fertilising.
- EM surveys, P removal maps and/or multi-year yield map combinations will identify different zones within a paddock and allow for optimal fertiliser applications rates across each zone.
- Take care with variable rate prescriptions as under-fertilising can be costly

The Australian Centre for Precision Agriculture (ACPA) and Riverine Plains Inc has been working in the area of zonal management for many years. Part of the project brief has been to assess the economics of the variable rate application of inputs versus applying a paddock average rate.

Methodology developed at the ACPA has enabled replicated fertiliser experiments to be established in paddocks containing two or three zones using commercial equipment see (Figure 1). Response curves to an applied input can then be produced for each zone to test their individual response to input, and also their overall yield potential.

Variable rate results

Figures 2 and 3 show the response curves from various rates of applied phosphorus in a paddock with low yields during 2006 and 2008. This paddock has been split into two zones called Class 1 and Class 2 according to their apparent electrical conductivity, which was determined by an EM38 survey.

Tables 1 and 2 indicate the rates of phosphorus required to maximise returns. From Table 1 it can be seen that during 2006, the optimum level of phosphorus was 19 kilograms per hectare or 86kg monoammonium phosphate (MAP)/ha for Class 2, as opposed to nothing in Class 1. In reality however, 24kg of phosphorus was applied per hectare across the entire paddock. This resulted in 24kg/ha of phosphorus being wasted in Class 1 and 5kg/ha of phosphorus being wasted in Class 2.

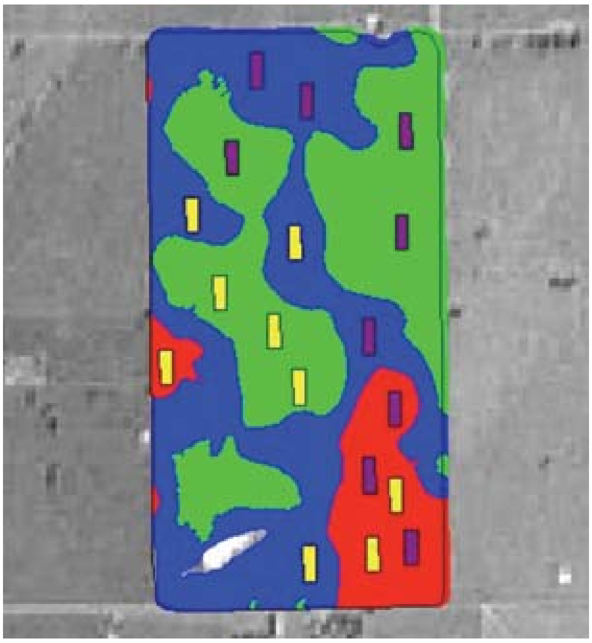

FIGURE 1 A paddock containing three zones*.

*A low and high rate of fertilizer are replicated three times in each zone. The middle rate is applied to the remainder of the paddock.

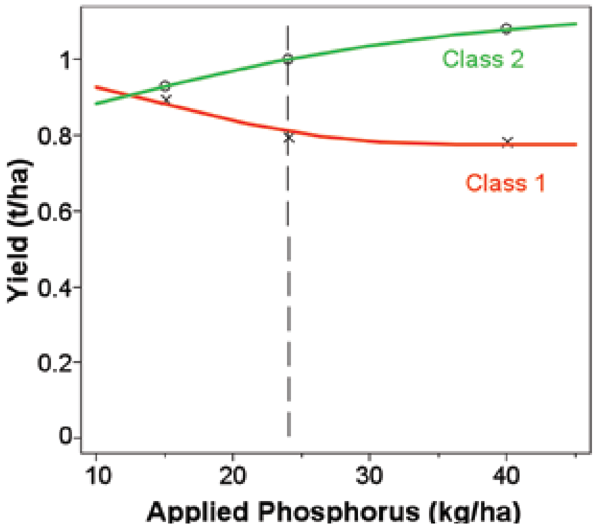

FIGURE 2 Wheat yield from applied phosphorus during 2006*

*This figure was derived from values of inputs and outputs for that particular year.

During 2008, while the response curves for each zone are a different shape, the level of change is so flat, that the rate of phosphorus required to maximise returns for both zones is almost nil. This result highlights the build-up of phosphorus in the soils after several years of low yields, and the negative impact that over-fertilising has on gross margins.

The results from variable rate phosphorus trials across a number of years and paddocks is shown in Table 3. The net wastage figure shows the theoretical potential for variable rate phosphorus. This figure is a combination of any under- and over-fertilising that occurred by applying an average rate across a paddock, and represents the amount by which gross margins could have been improved if the correct amount of phosphorus was applied to each zone in that particular year.

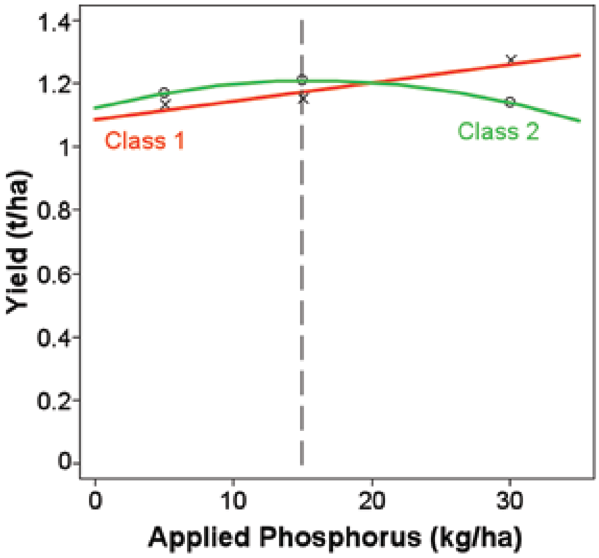

FIGURE 3 Wheat yield from applied phosphorus during 2008

Perforated line indicates paddock rate of phosphorus

TABLE 1 Monoammonium phosphate (MAP) required to maximise returns versus MAP applied to the actual paddock

	Applied phosphorus (kg/ha)	Optimum phosphorus (kg/ha)	Net wastage	
			Total $	$/ha
Class 1	24	0	1944.00	67.00
Class 2	24	19	59.00	2.30

TABLE 2 Rate of phosphorus required to optimise returns versus applied phosphorus during 2008

	Applied phosphorus (kg/ha)	Optimum phosphorus (kg/ha)	Net wastage	
			Total $	$/ha
Class 1	15	0	792	27
Class 2	15	2	638	24

TABLE 3 Net wastage resulting from applying paddock average rates of phosphorus

Year	Field	Size (ha)	Crop	Net wastage ($/ha)
2006	46	39	Wheat	60
2007	46	39	Wheat	107
2008	46	39	Wheat	59
2006	4	55	Wheat	35
2007	4	55	Canola	18
2008	4	55	Wheat	26
2007	7	91	Wheat	60
2007	39	43	Canola	47
2006	39	43	Wheat	70

To overcome all of the wastage shown in Table 3, perfect knowledge would be needed with regard to the yield potential of each season. Clearly this is impossible. However, the size of the wastage figures in many of the examples shown highlights the potential to improve gross margins considerably. Furthermore, when combined with nitrogen, lime and gypsum, a system allocating multiple inputs to zones according to their specific needs is likely to represent a significant efficiency gain.

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Variable rate technology — it makes sense *and* dollars

WRITTEN BY

Adam Inchbold on behalf of the Riverine Plains Inc Precision Agriculture project team

Variable rate technology allows for a targeted approach to fertiliser management in addition to the supply of lime and gypsum. In-paddock variation is now well recognised and growers will benefit from developing a sound information database on their own variable zones and soil conditions. Sound information provides for optimal decisions and maximum returns.

KEY POINTS

- **Management zones within paddocks can be determined initially through boundary mapping with EM38 surveys.**
- **Validate initial surveys with yield maps, paddock elevation maps and historical (farmer) knowledge and experience.**
- **Carry out soil tests in identified zones, including deep soil nitrogen (DSN) tests.**
- **Test strips within zones provide a sound method of testing profitability of variable fertiliser rates.**

Riverine Plains Inc. has been working in the area of Precision Agriculture (PA) since 2001. From the early days of demonstrating large variation in paddocks, in-field variation has been characterised, statistically proven and shown to be a robust and a common feature of the landscape. Based on this variation, management zones have been delineated and their individual characteristics established.

Given this variation, the concept that it is more appropriate to treat these zones individually, according to their own unique characteristics as opposed to a grouped paddock average, seemed to have a strong foundation. It seemed logical for instance that input prescriptions that relied almost entirely on soil parameters such as lime and gypsum, would be improved by using the characteristics from the individual zones than by paddock average soil tests.

An incredibly simple extension approach was used. Farmers were told they could apply the existing decision-making tools they used for lime and gypsum to zones, as if they were individual paddocks. While this was a very small step, it provided a simple entry point to the traditionally complex area of PA.

Mapping the variability

EM surveys were shown to provide a good, broad-brushed picture of soil type changes in paddocks. The usefulness of EM surveys meant farmers without yield mapping capability could still adopt site-specific management strategies. Additionally, EM maps contribute significantly to the process of clustering multiple layers of spatial data as growers' systems become more sophisticated.

Since 2003, a protocol established by the University of Sydney has been used to lay out replicated trials using farmer-scale equipment. These trials, examining the economics of variable rate nitrogen (N) and phosphorus (P) have frequently shown the potential benefit of the site-specific application of these inputs (see Table 1 and Figures 1a and 1b) and the variation in production potential of zones within paddocks (see Figure 2).

The benefits come from reduced over-fertilising and under-fertilising of areas according to underlying nutrient status and yield potential.

Test in the zone

As with lime and gypsum, variable nitrogen and phosphorus decisions can be made by soil testing individual zones instead of paddocks. While this approach may appear too simplistic, if paddock testing is the existing tool being used by growers, then testing in zones will be an improvement. However, other PA tools can be used to further support and improve nitrogen and phosphorus decisions.

Growers are currently using phosphorus removal maps, from the previous year's yield maps, and soil fixation information to improve the appropriateness of phosphorus allocation. This approach is particularly relevant after the third drought harvest. While some growers may be forced into applying just the phosphorus removed and fixed in the following season, a safer approach could be to simply vary the phosphorus prescribed from the average rate according to the percentage yield variation/ phosphorus removal. This latter approach provides a buffer against under-fertilising.

As is the case in general agronomy, site-specific nitrogen prescriptions can be difficult to provide. While they have their limitations, many deep soil nitrogen (DSN) tests have been taken in zones during the course of Riverine Plains' PA work, with significant differences being frequently detected. In one paddock, changes in DSN values within zones have been consistent with nitrogen removed according the previous year's yield map, giving credibility to the concept of taking DSN tests in zones. Furthermore, other work carried out by Riverine Plains has shown the accuracy of DSN tests is significantly improved by taking cores in zones of a similar soil type.

A note of caution however — as growers move into variable rate nitrogen and phosphorus, it is important they are advised to continue ground truthing and checking their tactics with test strips. This approach is vital to avoid under-fertilising.

Looking forward

Future PA work being conducted by Riverine Plains will focus on examining the usefulness of in-crop ground-based sensing for in-season yield prediction and refining nitrogen decisions. One approach may be to delineate nitrogen zones based on a series of images. This work will also help growers deal with temporal variation and its implications for yield targets and subsequent nitrogen decisions.

TABLE 1 Applied urea rates to achieve maximum return and maximum yield in field 44 during 2003 and 2004

Class	Presowing DSN 2003	2003 urea rate to maximise returns (kg/ha)	2003 urea rate to maximise yield (kg/ha)	Presowing DSN 2004	2004 urea rate to maximise returns (kg/ha)	2004 urea rate to maximise yield (kg/ha)
1	209	0	0	186	0	0
2	99	169	237	89	0	0
3	151	72	151	150	0	200

Courtesy of Brett Whelan and James Taylor, ACPA, University of Sydney

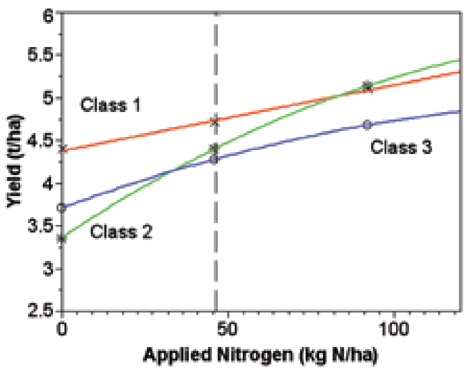

FIGURE 1a Applied nitrogen response functions for barley across three zones during 2005

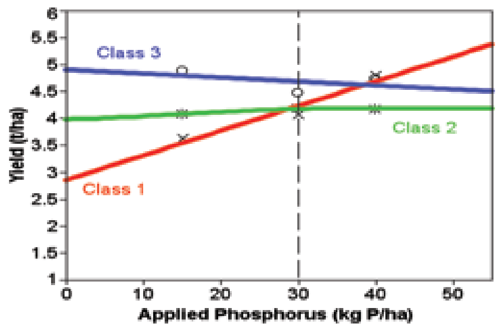

FIGURE 1b Applied phosphorus response functions for wheat across three zones during 2005

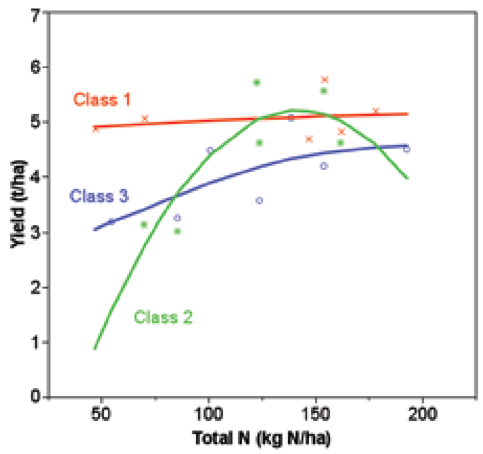

FIGURE 2 Total nitrogen response functions for barley across three zones during 2005

In conjunction with the above, work will continue in the area of establishing yield targets based on zonal characteristics. Much work has already occurred on monitoring individual zones' soil-moisture profiles. This work has shown that different zones have different drained upper limits and crop lower limits, leading to differences in theoretical yield potential. It is thought that a sophisticated approach to site-specific nitrogen will involve overlaying these yield potentials with in-crop data from ground-based imaging.

Alternative approaches

Zonal management is not the only approach to PA. For most growers the entry point to PA is guidance and/or autosteer. However, it is clear there is much more to be achieved in PA than this. If nothing else, a recognition of paddock variation will improve soil sampling and crop monitoring strategies. Beyond this, simple yet effective early steps can be taken by delineating zones, characterizing zones and using existing decision-making tools to make input prescriptions for individual zones rather than paddocks (see the following protocol).

As grower's become more experienced in PA, they will become more comfortable with including more spatial data in their PA strategies. In this sense, it is important they start as soon as possible. Beyond the simplest approaches of EM surveys and phosphorus removal maps, it takes a number of years to accumulate a solid bank of yield data.

Riverine Plains' runs two PA discussion groups to help growers adopt PA systems. The 'general' group targets growers starting out in PA, and the 'advanced' group provides growers with one-on-one advice for more sophisticated systems. Growers in this latter group are asked to share their experiences with their neighbours and other members of Riverine Plains.

The Generic protocol for adopting Variable Rate Technology promoted by Riverine Plains is as follows:

1. Electromagnetic (EM38) survey of the paddock.
2. Validate EM survey and zones against yield maps, vegetation index (NDVI) maps, other spatial data and grower knowledge.
3. 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.
4. Zone paddock/s (decide the number of zones after survey and ground truthing).
5. Develop variable rate lime, gypsum, phosphorus and/or nitrogen plots (+/-, standard rates, adjusted rates, need for strips or control).
6. Deep soil nitrogen test of zones.
7. Crop monitoring of zones.
8. Yield map.

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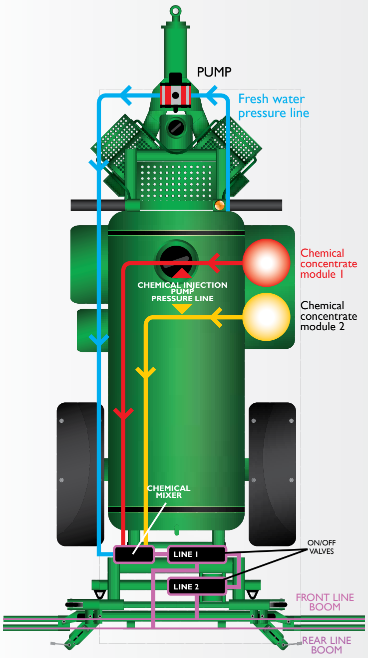

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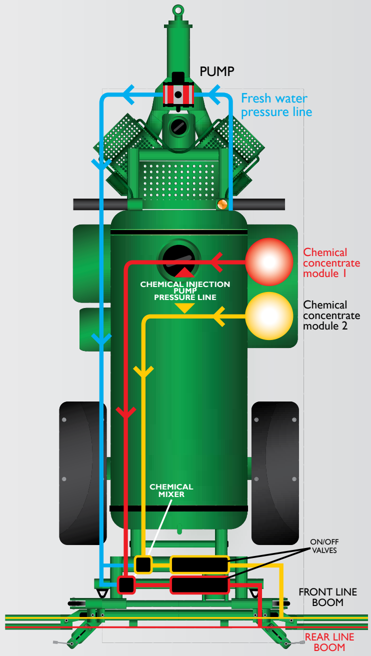

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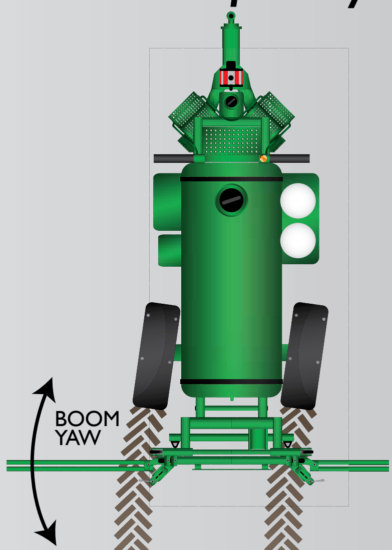

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Crop comparison after wheat and canola

WRITTEN BY
John Sykes John Sykes Rural Consulting

Location: Balldale
Growing season rainfall: **Annual:** 355mm (avg 504mm) **GSR:** 135mm (avg 319mm) **Stored moisture:** 72mm
Soil: **Type:** Red chromosol **pH (CaCl2):** 5.1 **Colwell P:** 82mg/kg **Deep soil N:** 73kg/ha
Sowing information: **Sowing date:** 23 May 2008 **Sowing fertiliser:** 90kg/ha MAP **Varieties:** see Table 1
Row spacing: 18cm
Paddock history: **2007** — wheat **2006** — canola
Plot size: 1.5 x 16m
Replicates: 3

KEY POINTS

- **Wheat on wheat following canola is an alternative that will enable more cereal crop to be grown in a rotation.**
- **Wheat or cereal after wheat has given a better return than more canola for the trial period 2004–2008.**
- **Barley yields and returns better profits than wheat or triticale under dry conditions.**
- **There were responses to fungicide treatments and added nitrogen in barley during 2008 and in all cereals during the long term.**

Aim

To test if wheat can be successfully grown after wheat and canola, and to assess if wheat is the best crop to grow at this point in the rotation.

Method

A replicated experiment was established during 2008 mostly using the same treatments to those used between 2005 and 2007.

Results

See Table 1 and 2.

Observations and comments

During the dry year of 2008, barley had the highest yield and best gross margin (see Table 1). This was also the case during 2006 and 2007.

During the four years, triticale had the best yield and barley the highest return.

The addition of nitrogen (see Table 1) significantly increased the yield of wheat, barley and triticale during 2008, and also on average throughout the period 2004–2008 (see Table 2).

The use of fungicide (see Table 1) did not significantly increase the yield of wheat or triticale during 2008. However, the use of fungicide (see Table 1) significantly increased the yield of barley during 2008. Throughout the period 2004-2008, (see Table 2) fungicides increased the yield of wheat, barley and triticale.

During the past four years, fungicide applications produced a yield rise in all cereals with a slight increase in gross margin in triticale and barley.

Canola yielded poorly during 2008 with negative gross margins. Its gross margin became more negative as additional inputs were applied.

During the period 2005–2008, canola has responded positively to nitrogen applications but not to fungicide applications.

Sponsors

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TABLE 1 Dry matter, yield and gross margin of the 2008 crop comparison experiment

Treatment description	Dry Matter (t/ha)	Yield (t/ha)	Gross Margin ($/ha)
Wheat 20kg/ha of P, 0kg/ha of N	2.4	0.8	24
Wheat 20kg/ha of P, 40kg/ha of N	3.0	1.4	112
Wheat 20kg/ha of P, 80kg/ha of N	3.1	1.1	-43
Wheat 20kg/ha of P, 120kg/ha of N	3.1	1.1	-102
Wheat 20kg/ha of P, 0kg/ha of N and fungicide	2.4	0.9	59
Wheat 20kg/ha of P, 40kg/ha of N and fungicide	3.0	1.5	121
Wheat 20kg/ha of P, 80kg/ha of N and fungicide	3.2	1.1	-53
Wheat 20kg/ha of P, 120kg/ha of N and fungicide	3.4	0.9	-160
Triticale 20kg/ha of P, 0kg/ha of N	2.3	1.0	54
Triticale 20kg/ha of P, 40kg/ha of N	2.6	1.6	119
Triticale 20kg/ha of P, 80kg/ha of N	2.9	1.2	-50
Triticale 20kg/ha of P, 120kg/ha of N	3.1	1.0	-164
Triticale 20kg/ha of P, 0kg/ha of N and fungicide	2.4	1.0	41
Triticale 20kg/ha of P, 40kg/ha of N and fungicide	3.0	1.4	68
Triticale 20kg/ha of P, 80kg/ha of N and fungicide	3.0	1.2	-46
Triticale 20kg/ha of P, 120kg/ha of N and fungicide	3.0	1.1	-140
Barley 20kg/ha of P, 0kg/ha of N	1.7	1.0	141
Barley 20kg/ha of P, 40kg/ha of N	2.2	1.7	271
Barley 20kg/ha of P, 80kg/ha of N	2.4	1.8	223
Barley 20kg/ha of P, 120kg/ha of N	2.6	1.7	115
Barley 20kg/ha of P, 0kg/ha of N and fungicide	1.8	1.5	265
Barley 20kg/ha of P, 40kg/ha of N and fungicide	2.2	2.0	352
Barley 20kg/ha of P, 80kg/ha of N and fungicide	2.5	1.5	128
Barley 20kg/ha of P, 120kg/ha of N and fungicide	2.5	1.4	36
Canola 20kg/ha of P, 0kg/ha of N	2.1	0.2	-13
Canola 20kg/ha of P, 40kg/ha of N	1.6	0.3	-54
Canola 20kg/ha of P, 80kg/ha of N	1.6	0.1	-218
Canola 20kg/ha of P, 120kg/ha of N	1.8	0.1	-292
Canola 20kg/ha of P, 80kg/ha of N and fungicide	1.9	0.1	-228
Canola 20kg/ha of P, 120kg/ha of N and fungicide	1.8	0.1	-297
Average	2.5	1.1	
Average (cereals)	2.7	1.3	
LSD	0.4	0.4	
CV	14.2%	11.6%	

Varieties — wheat (Ventura), triticale (Kosciusko), barley (Baudin), canola (Cobbler). Phosphorus applied at 20kg/ha to all plots as MAP. This included 12kg/ha of nitrogen. Fungicide — 3x 1L/ha of 125g/L Triademefon applied at Z31,Z39 and Z45 for cereals. Canola fungicide treated with Impact and Rovral for sclerotinia control at early flowering. Gross Margin – GM in $/ha. GM based on delivered local silo price of $280/t wheat, $190/t barley, triticale $200 (GST exclusive) and $550/t canola (GST exclusive) delivered Numurkah.

TABLE 2 2004-08 average grain yield (% of farmer wheat) and return (gross margin in $/ha) of the crop comparison experiment

Crop	Farmer [2]		High nitrogen [3]		High nitrogen and fungicide [4]	
	Yield (%)	GM ($/ha)	Yield (%)	GM ($/ha)	Yield (%)	GM ($/ha)
Wheat	100	148	141	158	156	155
Triticale	119	194	159	164	174	187
Barley	106	192	145	239	159	228
Canola[1]	34	42	45	28		
Lupins[1]	30	-16				

[1] 2005 to 2008 only. [2] Farmer — normal farm management including 0 nitrogen during drought years. Phosphorus applied at 20kg/ha as 90kg/ha of MAP which included 12kg/ha of nitrogen. [3] High nitrogen — Management as for 1 but 40kg/ha extra nitrogen applied post emergent. [4] High nitrogen and fungicide — As for 3 plus 3 x 1L/ha applications of 125g/L Triademefon fungicide applied at Z32, Z39 and Z45 for disease control in cereals.

Barley maximum yield experiment

WRITTEN BY
John Sykes John Sykes Rural Consulting

Location: Balldale

Growing season rainfall:
Annual: 355mm (avg 504mm)
GSR: 135mm (avg 319mm)
Stored moisture: 72mm

Soil:
Type: Red chromosol
pH ($CaCl_2$): 5.1
Colwell P: 82mg/kg
Deep soil N: 73kg/ha

Sowing information:
Sowing date: 23 May 2008
Sowing fertiliser: 90kg/ha MAP
Variety: Baudin

Row spacing: 18cm

Paddock history:
2007 — wheat
2006 — canola

Plot size: 1.5 x 16m

Replicates: 3

KEY POINTS

- **Barley responded to inputs of nitrogen (N) and fungicide during 2008.**
- **50 kilograms per hectare of seed was the optimum sowing rate.**
- **40kg/ha of nitrogen was required to maximise yield.**
- **Fungicide response was independent of nitrogen application.**

Aim

To assess the level of inputs required to maximise the yields of barley grown after wheat.

Method

A replicated experiment was established using differing levels of post-emergent nitrgen and fungicide to assess yield.

Results

See Table 1.

Observations and comments

The optimum sowing rate was 50kg/ha of seed in this trial.

Applications of up to 40kg/ha of nitrogen significantly increased the yield of barley. Yield decreased with additional nitrogen applications.

At the 50kg/ha sowing rate, fungicide increased yield significantly up to 40kg/ha nitrogen. Above 40kg/ha of nitrogen there was no response to either nitrogen or fungicide.

Using 50kg/ha of seed, 40kg/ha of nitrogen and fungicide gave the highest gross margin.

Sponsors

GRDC, Mr C Cay, Mrs S Cay.

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TABLE 1 Summary of yield and gross margin for barley for 2008

Treatment description	Yield (t/ha)	Gross Margin ($/ha)
50kg/ha 0N	0.9	106
50kg/ha 20N [1]	1.7	323
50kg/ha 40N	2.1	428
50kg/ha 80N	1.8	294
50kg/ha 120N	1.9	307
50kg/ha 0N+ fungicide [2]	1.4	121
50kg/ha 20N+ fungicide	2.1	318
50kg/ha 40N+ fungicide	2.4	542
50kg/ha 80N+ fungicide	1.5	244
50kg/ha 120N+ fungicide	1.9	344
100kg/ha 0N	1.0	46
100kg/ha 20N	1.9	299
100kg/ha 40N	2.0	287
100kg/ha 80N	1.5	117
100kg/ha 120N	1.9	344
100kg/ha 0N+ fungicide	1.2	145
100kg/ha 20N+ fungicide	2.0	374
100kg/ha 40N+ fungicide	2.1	375
100kg/ha 80N+ fungicide	1.9	299
100kg/ha 120N+ fungicide	1.8	263
20kg/ha 40N+ Fungicide	2.1	345
140kg/ha 40N+ fungicide	1.4	181
20kg/ha 80N+ fungicide	1.8	250
140kg/ha 80N+ fungicide	1.2	85
Average	1.7	268
LSD	0.35	
CV	11.7%	

[1] Rate of post-emergent nitrogen applied at Z23. [2] Fungicide — two applications of 500ml/ha of 125g/L Triademefon fungicide at Z30 and Z39.
GM based on delivered silo price of $200/t GST excl for F1 quality.

Triticale maximum yield experiment

WRITTEN BY

John Sykes John Sykes Rural Consulting

Location: Balldale

Growing season rainfall:
- **Annual:** 355mm (avg 504mm)
- **GSR:** 135mm (avg 312mm)
- **Stored moisture:** 72mm

Soil:
- **Type:** Red chromosol
- **pH ($CaCl_2$):** 5.1
- **Colwell P:** 82mg/kg
- **Deep soil N:** 73kg/ha

Sowing information:
- **Sowing date:** 23 May 2008
- **Fertiliser:** 90kg/ha MAP
- **Varieties:** Tobruk/Kosciusko

Row spacing: 18cm

Paddock history:
- **2007** — wheat
- **2006** — canola

Plot size: 1.5 x 16m

Replicates: 3

KEY POINTS

- **Triticale responded to nitrogen during 2008.**
- **Triticale did not respond significantly to fungicide during 2008.**
- **The variety Kosciusko yielded better than the variety Tobruk. Kosciusko did not respond significantly to 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 nitrogen and fungicide to assess yield.

Results

See Table 1.

Observations and comments

The addition of 20kg/ha of nitrogen significantly increased the yield of triticale. However, the addition of fungicide did not significantly increase yield.

The most economic treatment (gross margin) was 20kg/ha of nitrogen with or without fungicide.

Kosciusko yielded better than Tobruk with fungicide. Neither Tobruk or Kosciusko responded to fungicide.

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TABLE 1 Summary of 2008 grain yield and gross margin results for Triticale

Treatment	Yield (t/ha)	Gross Margin ($/ha)
0 N	0.8	130
20 N [1]	1.3	274
40 N	1.6	351
60 N	1.5	300
80 N	1.2	170
100 N	1.5	259
Fungicide [2] 0 N	1.2	129
Fungicide 20 N	1.5	377
Fungicide 40 N	1.5	326
Fungicide 60 N	1.4	275
Fungicide 80 N	0.9	91
Fungicide 100 N	1.2	180
Kosciusko + 40 N	1.7	348
Kosciusko + 40 N+ Fungicide	2.0	407
Average	1.4	
LSD	0.32	
CV	14.8%	

[1] Rate of post-emergent nitrogen applied at Z31. [2] Two applications of 500ml/ha of 125g/L Triademefon fungicide at Z30 & Z39.
GM based on triticale delivered at harvest to local silo at $220/t excl GST

Wheat maximum yield experiment

WRITTEN BY
John Sykes John Sykes Rural Consulting

Location: Balldale

Growing season rainfall:
Annual: 355mm (avg 504mm)
GSR: 135mm (avg 319mm)
Stored moisture: 72mm

Soil:
Type: Red chromosol
pH ($CaCl_2$): 5.1
Colwell P: 82mg/kg
Deep soil nitrogen: 73kg/ha

Sowing information:
Sowing date: 23 May 2008
Fertiliser: 90kg/ha MAP
Variety: Ventura

Row spacing: 18cm

Paddock history:
2007 — wheat
2006 — canola

Plot size: 1.5 x 16m

Replicates: 3

KEY POINTS

- **Wheat responded to up to 20 kilograms per hectare of nitrogen (N) during 2008.**
- **Wheat has not significantly responded to fungicides in 2008 or the other dry years.**
- **Over the full term of the experiment (2005-2008), wheat responded significantly to both fungicide and an average of 40kg/ha/yr of nitrogen (range 20-80kg/ha/yr).**

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 nitrogen and fungicide to assess yield.

Results

See Table 1.

Observations and comments:

- The use of nitrogen increased wheat dry matter production. The addition of 20kg/ha of nitrogen resulted in a significant increase in grain yield and gross margin.
- Use of fertiliser and seed dressings (Jockey, Impact and Triad) significantly increased grain yield and gross margin.
- The addition of in-crop fungicide did not significantly increase grain yield.
- Screenings were not adversely affected until more than 40kg/ha of nitrogen was applied.

Sponsors

GRDC, Mr C Cay, Mrs S Cay.

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TABLE 1 Summary of dry matter and grain yield, protein, screenings and gross margin results for 2008

Treatment description	Dry Matter [3] (t/ha)	Yield (t/ha)	Protein [4] (%)	Screenings [4] (%)	GM [5] ($/ha)
0N	2.3	1.0	12	1.5	86
20N [1]	3.1	1.6	14	1.2	190
40N	3.1	1.4	13	1.6	107
80N	3.1	1.2	18	3.8	-10
120N	3.3	1.3	17	12.3	-51
0N Fung [2]	3.0	1.2	13	0.8	124
20N Fung	3.1	1.6	14	1.2	195
40N Fung	3.1	1.5	14	1.2	117
80N Fung	3.2	1.5	16	6.5	52
120N Fung	3.4	1.2	16	18.7	-80
20N Opus	2.9	1.7	14	1.8	188
20N Tilt	2.8	1.5	14	2.1	147
20N Jockey	3.0	1.7	13	3.0	196
20N impact	3.1	1.9	13	2.4	261
20N Impact 1.5	2.8	1.9	13	3.2	240
20N Triad	2.8	1.9	13	2.1	271
LSD	0.4	0.2			
CV	16.2%	11.5%			

1. Nitrogen applied at Z31 2. Fungicide — two applications of 500ml/ha of 125g/L Triademefon (unless otherwise stated) at growth stages Z30 and Z39. 3. Dry matter assessment during late October near full maturity. 4. Protein and screenings — one sample from rep 1 only. 5. Gross margin — GM (whole $/ha) for grain yield based on $280/t (delivered local silo) and nitrogen @ $1.74/kg delivered.

Wheat fungicide experiment

WRITTEN BY
John Sykes John Sykes Rural Consulting

Location: Balldale	
Growing season rainfall: **Annual:** 355mm (avg 504mm) **GSR:** 135mm (avg 319mm) **Stored moisture:** 72mm	
Soil: **Type:** Red chromosol **pH ($CaCl_2$):** 5.1 **Colwell P:** 82mg/kg **Deep soil N:** 73kg/ha	
Sowing information: **Sowing date:** 23 May 2008 **Fertiliser:** 90kg/ha MAP **Variety:** Ventura	
Row spacing: 18cm	
Paddock history: **2007** — wheat **2006** — canola	
Plot size: 1.5 x 16m	
Replicates: 3	

KEY POINTS

- **Fertiliser dressings gave responses in wheat during 2008.**
- **There were no responses to in-crop fungicides.**
- **During the four years of the experiment, the best fungicide treatments have been the seed and fertiliser treatments and the in-crop fungicide sprays at growth stage Z39 (flag leaf emergence).**

Aim

To assess different fungicide timing and dressings for stripe rust control on the yield of a number of wheat varieties.

Method

A replicated experiment was established comparing different fungicides and seed or fertiliser dressings for their ability to control stripe rust on a number of wheat varieties.

Results

See Table 1.

Observations and comments

There was no difference between in-crop fungicide treatments during 2008.

All fertiliser treatments gave significant responses when compared with in-crop fungicides, probably due to root disease (take-all) present at the site.

There was no significant yield difference between the fertiliser treatments.

Protein levels were high in all treatments and screenings were low.

Over the full term of the experiment fertiliser and seed treatments gave about 10-15% higher yields than in-crop treatments and Triademefon gave equal responses to the other in-crop fungicides (Opus, Tilt and Folicur).

Higher rates of Impact did not produce significantly better yields during 2008 or previous years.

Triad fertiliser dressing gave the best gross margin during 2008 but was behind Impact in yield during the full trial period.

Sponsors

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TABLE 1 Summary of 2008 grain yield and gross margin and 2005-2008 average yields

Treatment description	Yield (t/ha)	Protein [1] (%)	Retention [1] (%)	Gross Margin ($/ha)	Yield 2005-2008 [2] (%)
Z30	1.2	14	1.4	83	88
Z30+Z39	1.1	14	1.7	57	98
Z39	1.2	15	1.6	88	100
Z45	1.1	15	1.9	52	69
Z39+Z45	1.3	15	2.1	92	103
Z30+Z39 Opus	1.1	15	1.8	37	100
Z30+Z39 Tilt	1.2	14	1.7	65	104
Z30 Opus	1.2	14	2.5	67	92
Z30+Z39 Folicur	1.3	14	2.7	102	105
Impact	1.7	13	1.9	187	115
Impact + Z30	1.6	12	1.7	175	115
Impact + Z39	1.6	13	1.6	157	114
Impact 1.5*	1.6	13	2.3	175	112
Triad**	1.7	13	2.6	215	110
Jockey***					110
LSD	0.3				
CV	9.7%				

* Impact 1.5 (2006-2008 only), ** Triad as four farmers Triad powder at 200g/ha, *** Jockey (2005-2007 only). 1. Rep 1 only. 2. Average yield from 2005-2008 as a % of Z 39 fungicide application (average yield was 2.2t/ha during life of trial), Z — Zadoc Growth Stage when the fungicide was applied. In-crop fungicide (where not stated) — Triademefon. Opus applied at 250ml/ha, Tilt at 250ml/ha, Folicur at 145ml/ha and Impact at 400ml/ha. Variety — Ventura.

Wheat inputs experiment

WRITTEN BY
John Sykes John Sykes Rural Consulting

Location: Balldale

Growing season rainfall:
Annual: 355mm (avg 504mm)
GSR: 135mm (avg 319mm)
Stored moisture: 72mm

Soil:
Type: Red chromosol
pH ($CaCl_2$): 5.1
Colwell P: 82mg/kg
Deep soil nitrogen: 73kg/ha

Sowing information:
Sowing date: 23 May 2008
Fertiliser: Double super
Variety: Ventura

Row spacing: 18cm

Paddock history:
2007 — wheat
2006 — canola

Plot size: 1.5 x 16m

Replicates: 3

KEY POINTS

- **Similar yield results can be obtained using a number of combinations of seed and fertiliser.**
- **Low tiller numbers can be recovered by using light amounts of nitrogen.**
- **There may be opportunities to use much lower initial inputs and still produce high-yielding and profitable crops.**

Aim

To assess the affect of varying the seed and fertiliser rates on the yield of wheat grown after wheat.

Method

A replicated experiment was established to test the effect of varying seed and phosphorus and nitrogen fertiliser inputs.

Results

See Table 1.

Observations and comments

A sowing rate of 35kg/ha was the optimum rate. No significant yield increase was achieved by increasing the seeding rate beyond this. The 70kg/ha sowing rate produced the optimum number of tillers but due to the dry season this did not produce the best yield.

Addition of nitrogen significantly increased yield at all sowing and phosphorus fertiliser rates, except at the 120kg/ha sowing rate.

Initially, low inputs (5kg/ha of phosphorus and 35kg/ha of seed as in 5P 35 S 40 N++) can be recovered by an early application of nitrogen fertiliser. Due to the dry season it was not possible to determine if the recovery would produce near maximum yields.

Similar yields could be produced with input savings of up to $78/ha during 2008.

Sponsors

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TABLE 1 Summary of plant counts, tillers, yield and gross margin for wheat inputs for 2008

Treatment description	Plant count (plants/m^2)	Tillers (Z15 t/m^2)	Tillers (Z32 t/m^2)	Tillers (Z70 t/m^2)	Yield (t/ha)	GM ($/ha)
12P 35S 0N	81	367	479	387	0.9	94
12P 35S 40N	86	458	351	378	1.4	221
20P 35S 0N	84	351	343	327	1.0	202
20P 35S 40N	93	472	336	409	1.4	303
12P 70S 0N	167	462	334	288	1.1	158
12P 70S 40N	174	495	351	405	1.4	303
20P 70S 0N	176	437	329	264	1.1	227
20P 70S 40N	180	523	338	323	1.5	246
12P 70S 80N	171	456	312	421	1.2	113
12P 120S 0N	223	561	342	260	1.0	190
12P 120S 40N	238	501	360	224	0.8	70
20P 70S 80N	164	481	574	329	1.0	51
20P 120S 0N	235	462	344	365	0.9	177
20P 120S 40N	239	479	339	318	1.0	120
12P 35S 20N	168	478	366	421	1.0	63
12P 70S 40N++	171	457	345	396	1.4	290
20P 70S 40N++	164	431	363	325	1.3	208
5P 35S 20N	86	258	327	298	1.1	180
5P 35S 40N++	91	294	340	409	1.4	268
5P 35S 80N++	78	306	357	427	1.3	208
5P 70S 40N++	162	507	497	386	1.5	246
12P 70S 40N No Fung	167	453	344	354	1.4	226
Average	154	440	367	351	1.2	
LSD	37	72	84	67	0.33	
CV	9.6%	12.4%				

Treatment nominated as rate of phpsphorus (XP) rate of seed (XS) rate of nitrogen (XN). ++ — Split nitrogen application with the first application of half the nitrogen at Z15 with the rest applied at Z31. Phosphorus applied as double super at sowing and nitrogen as urea at Z31 except for the split applications. All plots, except no fungicide, had two applications of 500ml/ha of 125g/L Triademefon at growth stages Z30 and Z39. Gross Margin (whole $/ha) based on $280/t (delivered local silo) and nitrogen @ $1.74/kg delivered.

Wheat phosphorus experiment

WRITTEN BY
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Location: Balldale

Growing season rainfall:
- **Annual:** 355mm (avg 504mm)
- **GSR:** 135mm (avg 319mm)
- **Stored moisture:** 72mm

Soil:
- **Type:** Red chromosol
- **pH ($CaCl_2$):** 5.1
- **Colwell P:** 82mg/kg
- **S (KCl):** 10.2mg/kg
- **Deep soil nitrogen:** 72kg/ha

Sowing information:
- **Sowing date:** 23 May 2008
- **Fertiliser:** Double super
- **Variety:** Ventura

Row spacing: 18cm

Paddock history:
- **2007** — wheat
- **2006** — canola (gypsum applied)

Plot size: 1.5 x 16m

Replicates: 3

KEY POINTS

- **Wheat responded significantly to up to 12 kilogram per hectare of phosphorus (P) without added nitrogen (N) and to 6kg/ha of phosphorus with added nitrogen.**
- **Higher fertiliser rates did not improve yield or tiller numbers.**

Aim

To assess the level of phosphorus required to optimise the yield of wheat grown after wheat in a high phosphorus soil.

Method

A replicated experiment was established using different rates of phosphorus (as double super) with and without added post-emergent nitrogen.

Results

See Table 1.

Observations and comments

Significant responses occurred to the addition of 6kg/ha and 12kg/ha of phosphorus (without additional nitrogen), even on this high phosphorus status soil. The addition of 20kg/ha of phosphorus did not cause a response.

The addition of post-emergent nitrogen, altered the phosphorus response making 6kg/ha of phosphorus the optimal rate. No significant yield increases occurred at higher rates of phosphorus.

The best gross margin was produced from 12kg/ha of phosphorus and 20kg/ha of nitrogen but 6kg/ha of phosphorus and 20kg/ha of nitrogen was not included as a treatment.

Sponsors

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TABLE 1 Summary of tiller number, yield and gross margin results for 2008*

Treatment — units of P and N applied (kg/ha)	Tillers (t/m^2)	Yield (t/ha)	Gross margin ($/ha)
0P 0N	322	0.8	34
0P 40N	325	0.8	-1
6P 0N	389	1.3	154
6P 40N	412	1.6	190
12P 0N	447	1.7	265
12P 40N	435	1.8	274
20P 0N	459	1.1	123
20P 40N	461	1.3	137
25P 0N	414	1.0	87
25P 40N	439	1.4	159
12P 20N	414	1.9	331
12P 80N	476	1.3	137
12P 120N	449	1.2	132
20P 20N	431	1.8	137
20P 80N	447	1.2	145
20P 120N	437	1.2	101
Average	422	1.3	
LSD	52	0.32	
CV	11.40%	14.80%	

* Phosphorus applied as double super at sowing. Nitrogen applied as urea at Z31.

Wheat sulphur and zinc experiment

WRITTEN BY

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Location: Balldale
Growing season rainfall: **Annual:** 355mm (avg 504mm) **GSR:** 135mm (avg 319mm) **Stored moisture:** 72 mm
Soil: **Type:** Red chromosol **pH ($CaCl_2$):** 5.1 **Colwell P:** 82mg/kg **Deep soil nitrogen:** 73kg/ha **Sulphur (KCl):** 10.2mg/kg (0-10 cm) 8.6mg/kg (0-60 cm) **Zinc (EDTA):** 0.5mg/kg
Sowing information: **Sowing date:** 23 May 2008 **Fertiliser:** 90kg/ha MAP **Variety:** Ventura
Row spacing: 18cm
Paddock history: **2007** — wheat **2006** — canola (gypsum applied)
Plot size: 1.5 x 16m
Replicates: 3

KEY POINTS

- **Wheat did not respond significantly to additional sulphur (S).**
- **Wheat did not respond significantly to additional zinc (Zn).**

Aim

To determine if wheat would respond to post-emergent applications of zinc and different products containing sulphur and nitrogen.

Method

A replicated experiment was established using zinc and different products containing sulphur and nitrogen. These were applied post emergent at growth stage Z17 (early August). Based on the soil test, the site was considered to be marginal for sulphur (critical potassium chloride level is 7 milligrams per kilogram) and zinc.

Results

See Table 1.

Observations and comments

The addition of 20kg/ha of nitrogen resulted in a significant increase in yield and gross margin over nil nitrogen, regardless of the product used.

The addition of sulphur in any form (gypsum or sulphate of ammonia) did not increase yield. This was most likely because wheat has a low sulphur requirement and the site was not critically low in sulphur.

Addition of zinc did not increase yield.

Protein and screenings were not affected by the amount of nutrient applied or the product used.

Sponsors

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TABLE 1 Summary of yield, protein, screenings and gross margin for 2008

Treatment description	Yield (t/ha)	Protein [6] (%)	Screenings [6] (%)	Gross margin [7] ($/ha)
0N [1]	0.9	14	1.6	55
20N	1.5	14	1.5	158
20N + Zn [2]	1.4	15	1.8	137
25N	1.3	15	1.9	108
Gypsum [4]/urea 15/20 [3]	1.4	14	1.4	136
Gypsum/urea 22/25	1.4	14	1.2	128
SOA [5] 22/25	1.4	15	1.9	101
SOA/urea 15/20	1.4	14	1.1	107
LSD	0.3			
CV	14.8%			

[1] Nitrogen — all treatments applied at Z17 (7 leaf stage) during early August. [2] Zinc as 5kg/ha of zinc sulphate. [3] Sulphur rate applied/nitrogen rate. [4] Gypsum assuming 18% sulphur. [5] Sulphate of ammonia (SOA) fertiliser containing 22% sulphur and 25% nitrogen. [6] Protein and screenings based on one sample from Rep 1. [7] Gross Margin (whole $/ha) based on $280/t (delivered local silo), urea @ $800/t and sulphate of ammonia at $650/t delivered. All treatments received one application of 500ml/ha of 125g/L Triademefon at growth stages Z33.