Hyper Yielding Cereal Project
A FEED GRAIN INITIATIVE

FAR AUSTRALIA

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

SFS Southern Farming Systems

Thursday 17 November 2016

10:00am – 4:00pm including barbeque lunch and afternoon tea

Badcock Lane, Hagley, Tasmania

The project steering committee would like to thank the following event sponsors:

Trial site courtesy of

Botanical Resources AUSTRALIA

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VISITOR INFORMATION

We trust that you will enjoy your day with us at the Hyper Yielding Cereals Project Inaugural Field Day. Your health and safety is paramount, therefore whilst on the property we ask that you both read and follow this information notice.

HEALTH & SAFETY

- All visitors are requested to follow instructions from FAR and SFS staff at all times.
- All visitors to the site are requested to stay within the public areas and not to cross into any roped off areas.
- All visitors are requested to report any hazards noted directly to a member of FAR or SFS staff.

FARM BIOSECURITY

- Please be considerate of farm biosecurity. Please do not walk into farm crops without permission. Please consider whether footwear and/or clothing have previously been worn in crops suffering from soilborne or foliar diseases.

FIRST AID

- We have a number of First Aiders on site. Should you require any assistance, please ask a member of FAR or SFS staff.

LITTER

- Litter bins are located around the site for your use; we ask that you dispose of all litter considerately.

VEHICLES

- Vehicles will not be permitted outside of the designated car parking areas. Please ensure that your vehicle is parked within the designated area(s).

SMOKING

- There is No Smoking permitted inside any marquee.

Thank you for your cooperation, enjoy your day.

On behalf of the steering committee, I am delighted to welcome you to the Hyper Yielding Cereal Project Inaugural Field Day.

Led by the Foundation for Arable Research (FAR) Australia in collaboration with Southern Farming Systems (SFS), the Hyper Yielding Cereal Project is funded by The Grains Research and Development Corporation (GRDC) and is aimed at boosting Tasmania's production of high quality feed grain cereals and thereby reducing its reliance on supplies from the mainland.

The project will be front and centre of today's field event and will showcase this research site dedicated to improving the ability of the State's farmers to grow high yielding feed grain wheat and barley.

The GRDC recognised some time ago that a huge opportunity exists for Tasmania to produce much greater volumes of feed grain cereals with new irrigation schemes coming online. It also recognised that with favourable quality attributes there was a growing market in the state's dairy sector.

How did the project originate?

Despite a more favourable climate for grain production compared with the mainland, and greater yield potential, Tasmania remains a net importer of cereal grains. We want to see Tasmania become more self-sufficient in its capacity to supply feed to the State's dairy industry and other livestock users.

The project was established to bridge the gap between actual and potential yields through genetic improvement of crops, best practice in terms of management of those crops and recognition of quality for the key end users. To that end, much progress has already been made in the initial screening of new cultivars for disease resistance and traits suitable for the Tasmanian environment.

Project objectives

With input from national and international cereal breeders, growers, advisers and the dairy industry, the project is working towards setting record yield targets as aspirational goals for growers of feed grains. With the right incentives, the project

steering group believes it will be possible to encourage breeders to place greater focus on the needs of Tasmanian growers.

To focus on these objectives, the project has been set the challenge of:

- Increasing average Tasmanian red grain feed wheat yields from 4.4t/ha to 7t/ha by 2020;

- Delivering commercial wheat crops which yield 14t/ha by 2020;

- Identifying and endorsing the value of metabolisable and digestible energy in feed grain cereals through engagement and collaboration with the dairy industry.

The project will result in the creation of an internationally-linked centre of excellence for feed grain cereal production, based in Tasmania. This centre along with a series of regional focus farms will be focused on developing improved varieties, generating variety specific agronomy packages and introducing new parameters for describing feed grain quality for dairy industry end users.

Key findings from the research to date will be presented to growers, dairy farmers and industry personnel attending today's field day.

Today's event

The event will feature research trial demonstrations and a line-up of international, mainland and Tasmanian speakers who will discuss various aspects of improved germplasm and agronomy, grain quality and dairy nutrition strategies.

To endorse the project's international linkages, our keynote speaker for the event is Patrick Stephenson, one of the UKs leading agronomists. Patrick who works for NIAB TAG, the UK's largest independent farmer focused research organisation will share his international agronomy expertise with Tasmanian growers.

Should you require any assistance throughout the day, please don't hesitate to contact a member of the FAR or SFS team who will be more than happy to help.

Thank you once again for taking the time out of your busy schedule to join us today; we hope that you find the presentations useful, and as a result, take away new ideas which can be implemented in your own farming business. Have a great day and we look forward to seeing you again at future project events.

Nick Poole
Managing Director
FAR Australia

Funding Acknowledgements
The Hyper yielding cereal project steering group would like to place on record its grateful thanks to the Grains Research & Development Corporation (GRDC) for their funding support for this event and project.

Sponsorship acknowledgement
The Hyper yielding cereal project steering group would also like to acknowledge the sponsorship support given by Roberts to assist with catering and TP Jones for supporting the travel costs of our keynote speaker Patrick Stephenson from NIAB TAG in the UK.

Hyper Yielding Cereal Project
A FEED GRAIN INITIATIVE

TIMETABLE

Opening address by Keith Pengilley, GRDC Southern Panel Chair

In-field presentations	Station No.	10:00	10:30	10:45	11:15	11:45	12:15	12:45	1:45	2:15	2:45	3:15	3:45
Towards 14t/ha feed wheat yields in Tasmania - given such a challenge what can we learn from agronomy techniques in the UK? **Patrick Stephenson, NIAB TAG, UK**	1	morning tea	welcome and opening address					lunch					afternoon tea and close
Formulating the best priced dairy diet - what are the key attributes of grain quality that are important for dairy cow nutrition? **Ian Sawyer, Feedworks Ltd**	2												
What are the key ingredients for world record barley yields? **Warren Darling, Cropping Farmer, New Zealand**	3												
Managing feedlot grain supplies - what are our requirements? **Andrew Thompson, Tasmanian Feedlot Pty Ltd**	4												
Influence of physical grain quality on dairy cow performance in TIA research. **Mark Freeman, TIA Dairy Centre** **Dr. Ray King, Dairy Australia**	5												
Advances in cereal grain productivity in New Zealand – towards 20t/ha by 2020. **Nick Pyke and Rob Craigie, FAR New Zealand**	6												
How can we use Plant Growth Regulators (PGRs) to keep our crops standing when yields exceed 10t/ha? **Jon Midwood, Southern Farming Systems**	7												
What cereal grains and quality do we need to grow the grains industry in Tasmania? **David Skipper, Tasmanian Agricultural Producers**	8												
The importance of an integrated disease management (IDM) approach to disease control inTasmanian cereal crops. **Tracey Wylie and Nick Poole, FAR Australia**	9												
Increasing wheat yields in Tasmania - how much can we do with agronomy versus germplasm? **Nick Poole, FAR Australia**	10												
Maximising the yield and margins of barley in the Tasmanian environment. **Heather Cosgriff, Southern Farming Systems**	11												
Panel discussion: Increasing Cereal Productivity **Terry Horan, Roberts Limited** **Patrick Stephenson, NIAB TAG, UK.** **Warren Darling, Cropping Farmer, New Zealand**	12												
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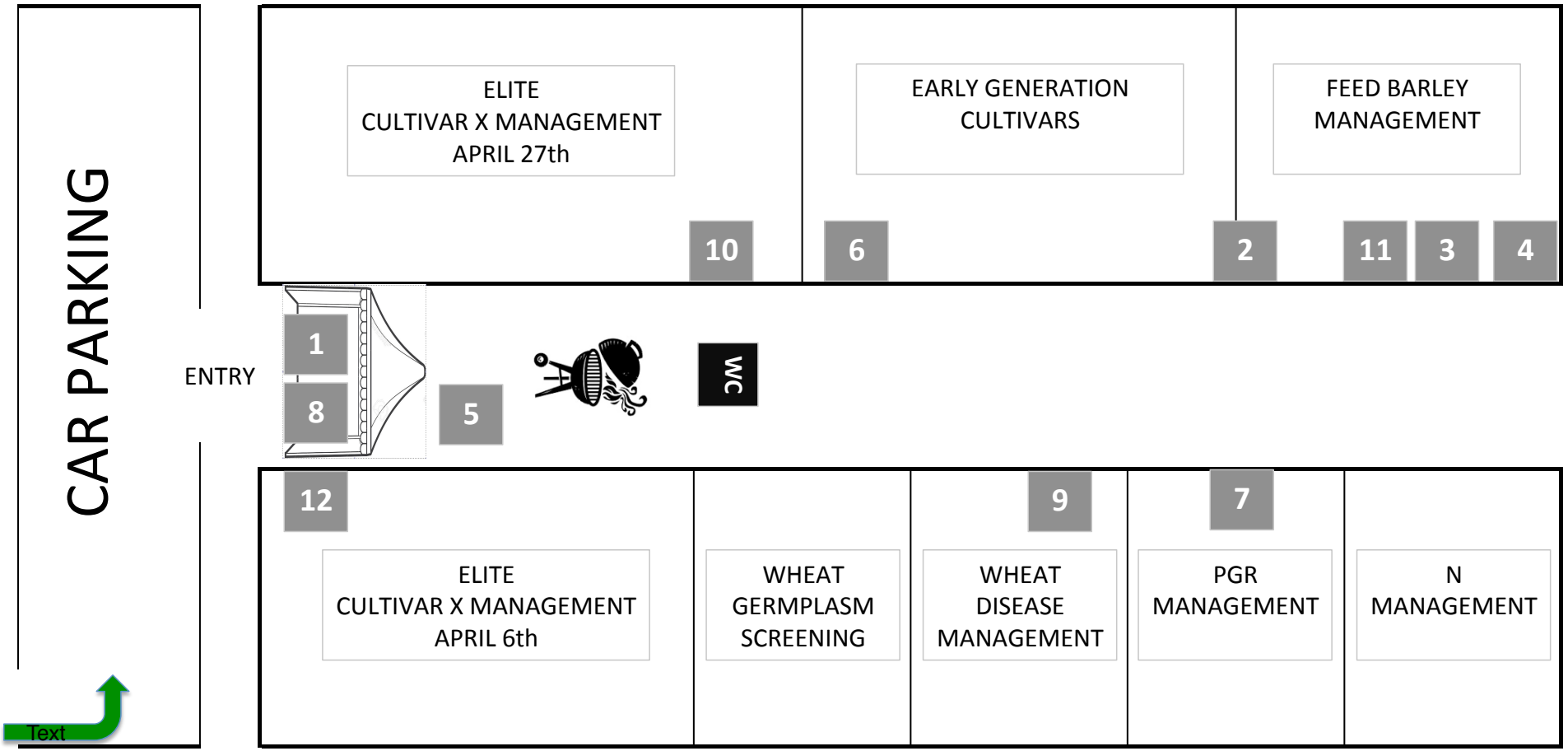
SITE PLAN



Not to scale

Station 1

10:45pm and 1:45pm

Patrick Stephenson
NIAB TAG, UK

Towards 14t/ha feed wheat yields in Tasmania – given such a challenge, what can we learn from agronomy techniques in the UK?

The United Kingdom wheat production system has been heavily input driven. To a certain extent we could be described as 'hooked on high input and high output'. Looking back at national wheat average yields we can see a mixed picture. There have been three stand out years 1984, 1997 and 2015. The single factor that links these three years together is the weather patterns. For each of these years the peak has risen slightly higher and although weather has been important, agronomy techniques have also evolved considerably over this time scale. The key issues for achieving high yields are discussed below.

Plant Genetics

Breeders have made 'big strides' in plant genetics, although this would be the claim by wheat breeders the reality is somewhat different. Viewing the UK national wheat recommended list, wheat yields do show an upward trend in yields since the eighties. This is not meteoric but is increasing with an average yield improvement of 0.3% per year since 1984. Traits of improved straw strength, and increases in grains/m² have been important attributes manipulated by agronomists to achieve higher yields. It could be argued that the introduction of European winter wheat breeding lines into New Zealand in the early 90's was the catalyst for the rise in New Zealand wheat yields.

Nitrogen

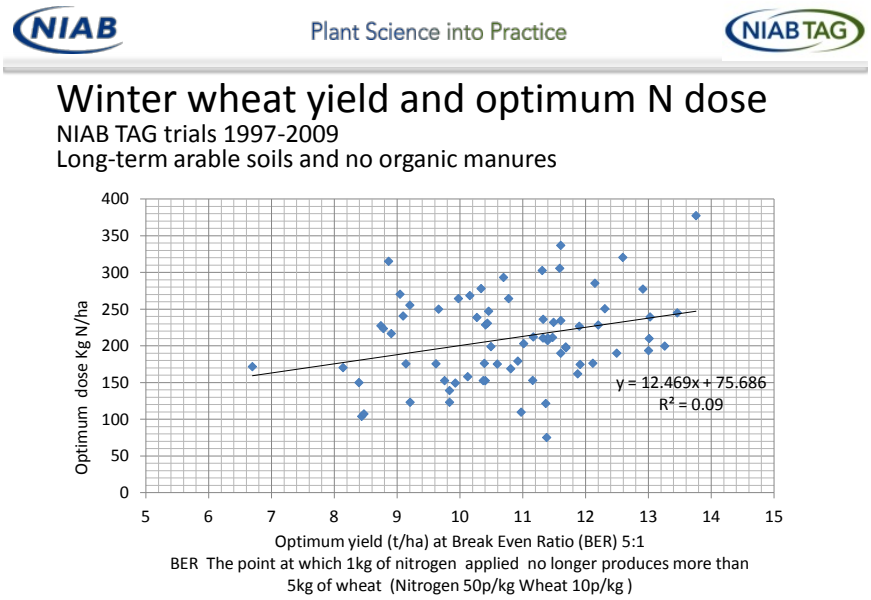


Figure 1: Winter Wheat Yield Response To Increasing Nitrogen Rates

The graph opposite shows the loose, but undeniable, correlation that higher yields are related to increase in nitrogen levels. The dilemma grower's face is that at the time of fertiliser application the final yield is unknown. The advantage that the United Kingdom has is that despite people's concepts the climate is benign and to a point predictable. Growers will target 12.5 t/ha and apply (depending on various factors) 240 kg/ha of Nitrogen. Those chasing very high yields will speculate with additional amounts.

Disease Management

Disease management of cereals in the UK has gone through a revolution in recent years. In 1984 the average number of fungicides applied to the UK wheat crop, would be less than two across the country, by 1997 it would nearly be three and by 2015 nearly four. Understanding and managing disease has become a key component of maximising yield but also minimising risk.

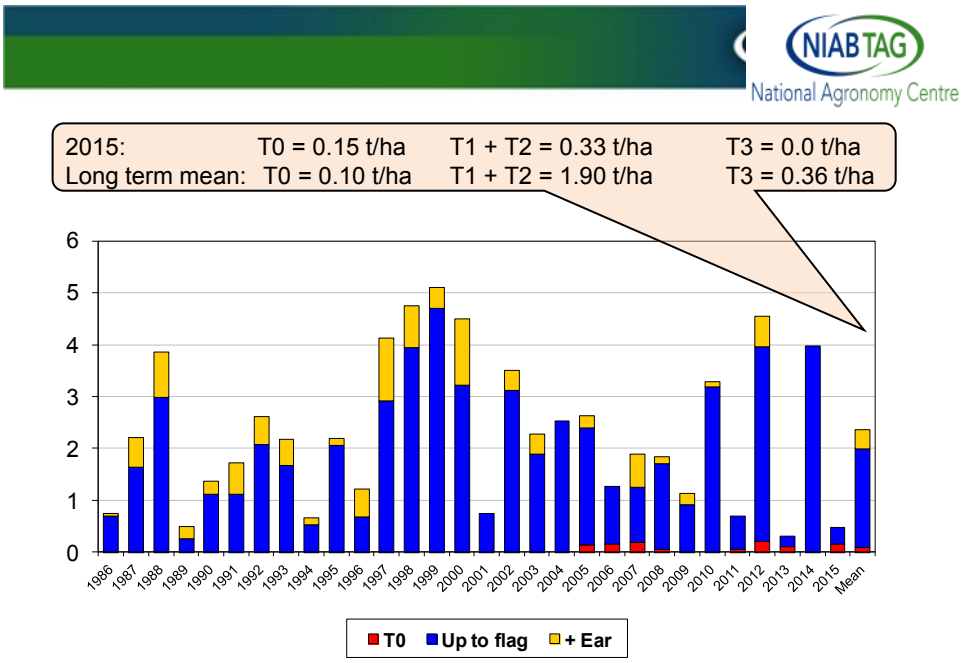


Figure 2: Winter Wheat Yield Responses To Different Fungicide Timings

The graph above shows the longest running dataset on fungicide response by timing in the UK and outlines the current four main spray timings. The average response of 2.36 t/ha ensures that growers pay attention to disease control. However, this has brought into sharp focus the reliance on fungicides and the vulnerability of this system to resistance issues. Utilising resistant varieties and planning will help Tasmanian growers adopt and learn from this UK experience.

Crop Structure

The breaking of the world wheat record by Mike Solari, Invercargill back in 2008, led to a flurry of papers breaking down the mechanics of how the yield was achieved. This included detailed analysis of the weather pattern, tiller numbers, ear numbers and grains per ear required to fulfil the yield achieved. Roger Sylvester Bradley predicted that the maximum that could be achieved in New Zealand was 19 t/ha. Many highlighted the whole in the ozone layer, the latitude and solar radiation levels as unique to New Zealand and that the record would not be beaten. Yet in 2015 the world record was broken in Northumberland in the UK. Crop structure was certainly one of the key components, but also using high nitrogen rates and growth regulators were important. The coastal location was another key issue for this crop, together with free draining soil. There is little doubt that the overriding factor was the weather pattern in June. Lower June temperatures with high radiation figures (40% above the average) ensured that the crop was supplied with the energy to produce record yields.

Agronomy

Agronomy is also a key component when considering how to increase yields. Drilling helps to ensure that the crop establishes well and has every opportunity to produce around 900 tillers in the spring. The target then is to maintain 600 fertile tillers for harvest. This combination of early drilling, robust seed rates and high nitrogen means that natural disease resistance in a variety is crucial. High resistance scores ensure that disease can be managed through the year to achieve optimum yields as has been shown in the FAR NZ 20 by 2020 project.

Station 2

12:15pm and 3:15pm

Ian Sawyer
Feedworks Ltd

Formulating the best-priced dairy diet – what are the key attributes of grain quality that are important for dairy cow nutrition?

The dairy sector in Australia is often compared to our NZ cousins, and this is particularly so in Tasmania. In both cases the focus is often on maximising grazing forage growth and consumption. That is logical and entirely correct.… not because grass is cheap. When land value and finance cost is considered grass is often not cheap but rather because pasture utilisation is a measure of capital asset utilisation. Greater tonnes/ha utilised means better asset efficiency, and better farm profitability links.

One of the Australian dairy sector's competitive advantages relative to NZ is that we have a great many options beyond grazed pasture that can be value added effectively into milk. It can be said that the less reliable environment means this is necessary…. but it is a certainty that the availability of cost effective grain in particular is an area that lends competitive advantage to our dairy sector relative to other regions of the globe, for example New Zealand.

Integrated with good land use efficiency, we can use grain to ensure cow production levels produce better feed conversion efficiency, better stocking rates and better productivity and profitability per ha. Bring it together well and we can have a formidable combination of land and cow use efficiency that can be very sustainable. Most certainly it's a better option than hungry cows in our less reliable seasonal conditions!

So what do we want from grain applied in local sector? Principally we want a high MARGINAL RESPONSE. That is the amount of milk/milk solids that we make from the provision of the kg of grain. We know that this is a variable parameter, and can sit anywhere from 2+L/kg of grain provided…. down to 0L/kg grain provided. Regrettably an inaccurate middle ground is often quoted that says 1kg grain = 1kg milk. It's a terrible guide and inaccurate at either end of the spectrum.

As a nutritional sector we must become better at ensuring improved responses to provided grain based supplements if we wish better economic response, and essentially farm business profitability.

To do that we must address two main factors that impact on how successful grain responses are on farm:

1- Associative effects: This is the impact that grain has on other factors of cow metabolism and nutrition. It can be both a negative or a positive (e.g. grain and starch create ruminal impacts that reduce fibre digestibility and overall diet digestibility and intake, or eg. grain creates increased ruminal microbial growth and also an insulin response that promotes both milk protein yield and milk volume).
2- Appropriate metabolic fuels: it may surprise some to hear that all energy is not created equal. A megajoule is not a megajoule. Grain is essentially a starch source when applied in ruminants, and starch is a specific energy fuel that is very valuable to cows at specific stages of lactation…. yet less crucial at other stages. Even starch itself can have differential impacts based on its rate of breakdown. Very rapid starch breakdown can create issues with ruminal stability and sub acute acidosis, and it can create negative feed back mechanisms via the liver to brain that depress grazed feed intake. Both reduce the marginal response to grain.

Australia is blessed with a pretty large grain harvest that is accessible to the dairy sector in Tasmania both locally and via the main land. Most of this of course is winter cereal grain (wheat, barley). This is of variable starch content, but invariably is rapidly fermentable. The challenge we face is that the grain and starch the cow prefers is not always the same profile as the grain/starch we provide her. As an extra challenge the profile of the ideal grain changes not only with the cow's metabolism across lactation, but with the amount we feed her and her level of production.

So what does "ideal" starch (grain) look like across lactation?

Transition/ fresh cow: This cow has a high demand for glucose to support lactose and thus increasing milk flow, also glucose to bring back insulin levels and slow body weight loss. Starch is thus ideal as it's a very good precursor of glucose. Rapidly fermented starch however can produce a lowered overall feed intake grazed by metabolic feed back. So higher starch and higher grain intake is good, but slower starch breakdown is preferable. Corn/wheat combinations for example work beautifully. They provide ideal metabolic fuels, reduce ruminal impacts and promote grazing intake. Marginal responses are optimised in this manner. Specific amino acids are also needed to "get the mammary gland in the mood", so protein meals like canola meal remain important even if pasture protein is high. Even at 26% protein pastures the protein QUALITY won't get it done for the mammary gland.

Peak lactation: Peak milk means peak lactose demand, so we still need ample starch provision. It gives us energy in a form that digestible fibre can't provide. Both the rumen and the liver are match fit now, so we can have faster fermenting starch and not impact grazing behaviour. That is good for reducing complexity. Appropriate dietary protein remains important to keep the mammary gland keen.

Post peak (second 100 days of lactation): Milk will gradually decline, and that means the amount of starch and glucose precursor can drop a bit accordingly as milk naturally declines 6-7%/month. Digestible fibre sources become very viable energy options. That means barley rather than wheat is more viable post peak (assume about 10% less starch in barley to wheat). Depending on cow production you can reduce your protein meal delivery too. No slow starch needed much here either.

Last 100 days 200-305: Increasingly digestible fibre sources and lower starch levels are fine, and in fact can be preferable (again depending on cow production level). So barley is great in later lactation. Higher starch and faster starch in late lactation favours body weight gain rather than the vat. In late lactation bring some protein in as well to favour the vat not body weight gain. The cow naturally gets her insulin status back in late lactation, so blood glucose goes to her back not the vat. The opposite of early lactation when she basically has the overhang of gestational diabetes. But we want milk flow late in lactation so we must provide the right energy fuels to promote that.

Conclusion: The right or ideal grain varies across the cow's status in lactation as well as her production level. We can best match this with grain and protein meal combinations. Single grains alone most often don't provide the best energy precursors. The marginal response is thus less than ideal.

ALL ENERGY IS NOT CREATED EQUAL

Station 3

11:15am and 2:15pm

Warren Darling
Cropping Farmer, New Zealand

What are the key ingredients for a world record barley yield?

With over 30 years' experience New Zealand farmer Warren Darling knows what works at Poplar Grove, a coastal farm in Timaru, on the East Coast of the South Island. Poplar Grove has a crop rotation of wheat, barley and oil seed rape.

On 23 January 2015 Warren achieved a Guinness World Record for the highest barley yield of 13.8 tonnes per hectare from an 11.6 hectare paddock.

Over the last nine years Poplar Grove has used a min-till system based on Northern Hemisphere farming practice, using a one pass cultivator which incorporates residues, subsoils and presses the soil in one pass, this system increases soil health. Drilling is done with a cultivator drill which prepares the seed bed and seeds in one pass.

- Residue management
- Soil
- Variety
- Agronomy
- Climatic conditions

RESIDUE MANAGEMENT:

A successful barley yield at Poplar Grove starts with the harvesting of the previous season's wheat crop – dealing with residue which is incorporated back into the soil to build organic matter.

SOIL:

Poplar Grove soils are cultivated to a depth of 250-300mm giving a consistent profile and aiming for even nutrient levels throughout the profile.

Avoid soil compaction – NB: all soil types suffer from some form of soil compaction

1. Natural weathering
2. Livestock grazing
3. Machinery

VARIETY:

1. Choosing a variety that performs to its highest potential on our property using Poplar Grove management – we do our own on-going farm trials to select the best variety.
2. Seed rates – plants per metre^2. At drilling time Poplar Grove aims for 100 plants per metre^2.
3. Drilling – speed of 12kph for even plant distribution.

AGRONOMY:

We use the best agronomy advice available.

1. Fertiliser – variable rate applications for base fertiliser – budgeted nitrogen: assume 25kg N/tonne of grain produced.
2. Micronutrients – regular plant tissue testing.
3. Chemicals – herbicides and fungicides - Poplar Grove use a three spray fungicide programme based 30 days either side of early flag leaf.
4. Plant growth stages – timing of applications is crucial.

CLIMATIC CONDITIONS:

The success of the Poplar Grove crops relies on winter rain to build up moisture in the sub soil, coastal breezes give us clean air to limit disease pressure, cool dewy nights during the flowering and early grain fill and then plenty of sunshine during harvest consistently helps to produce high yields.

Station 4

11:45am and 2:45pm

Andrew Thompson
Tasmanian Feedlot Pty Ltd

Managing feedlot grain supplies - what are our requirements?

Tasmania Feedlot at Powranna is a wholly owned subsidiary of the largest Japanese retailer AEON. All of our grain fed beef production is sold in Japan through the parent company network of stores. We turnover about 17-18,000 head of Tasmanian Angus cattle p.a. (mainly steers but also some heifers) plus some local custom feeding on a seasonal basis.

Our grain requirements are for F1 spec. barley of about 25-30,000 MT p.a. which forms about 40% of our ration. We use 100% barley as our grain component as it is less volatile than wheat, particularly in our wintery climate. The barley is steeped with around 8% moisture added overnight then rolled the next day. We require consistently sized grain for better milling performance - the intent is to crack all grains without creating too many fines so that the starch is more accessible for the rumen microbes. The more consistent the grain, the more consistent is the milling process and the cattle then show more consistent performance.

We are producing high quality, safe beef for the Japanese market and need to ensure that all feed components including the barley are safe. i.e. No gmo's, no residues of chemicals (so we need a spray history to justify that, including any chemicals used in the storage of the grain). The Japanese market has a strong aversion to poppies, so we have to be very careful not to have any contamination of grain from previously grown poppy crops. So we insist on F1 quality barley and vendor declarations to back up the safety of the grain. We do test grain for screenings, test weights and moisture and we retain samples from every truckload delivered at the feedlot. Some of those samples are then sent away for residue testing to comply with our strict QA system (SQF) for our Japanese market. We require traceability of the grain to particular vendors or to a group of vendors where it has been co-mingled in storages.

We have been using mainly grain from the mainland in recent years due to the shortage of barley production in Tasmania with an emphasis on poppies and winter feed wheats and other wheat for the dairy industry. That mainland grain has usually been purchased on a contract the year before to guarantee our supply of grain. It is mainly sourced from Victoria and southern NSW. The mainland grain is delivered in 20 ft containers on a regular basis, spread over the whole year, so does not create any storage issues. Handling and storage of local Tasmanian production during the harvest season can be an issue. We have approx. 2000mt of silo storage at the feedlot and an additional 2000mt of short term covered storage. The cost structure of handling and storage of grain in Tasmania is quite a lot higher than on the mainland due essentially to lack of scale, so any expansion of the Tasmanian industry needs to be aware of these cost and logistical issues.

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Station 5

11:45am and 2:45pm

Mark Freeman
TIA Dairy Centre

Influence of physical grain quality on dairy cow performance in TIA research

Seven separate experiments could not determine any discernable differences between “red” and “white” wheats and the conclusion from the research program was dairy farmers should choose their wheats on the result of feed tests and buy on quality parameters.

The project concluded there was evidence of differing rates of fermentation in the rumen with differing wheat samples and the difference could be largely attributed to the yield per hectare, as starch content is higher with higher yielding crops. Thus, the effect of environmental conditions on grain filling and ultimately wheat yields probably play a very important role in influencing rumen fermentation characteristics.

The temperatures prevailing during the drying period affect grain hardness, with low temperatures promoting a looser protein matrix, which results in softer wheats. Research indicates the conditions under which wheat is grown can have as large (if not larger) affect upon the final physical and chemical characteristics of wheat, as can result from the variety choice.

During the research period several factors that affect how grain is used on dairy farms were highlighted as possible causes of poor cow production when changes are made to the wheat source being fed.

Grain size and hardness. For farmers who roll or crush their own grain, grain size and hardness can affect how well the grain is crushed. Changing from a small hard wheat to a soft large wheat and not altering the gaps in the roller mill will result in the wheat being ground finer, increasing the risk of acidosis as in rumen fermentation will be faster. Grain size is both a factor of variety and site (environmental conditions when growing).

Hectolitre weights. Many farmers are unaware of the differing densities of concentrates obtained from different sites and fail to recalibrate their parlour feeders when receiving new deliveries of wheat. Dairy farmers feed concentrates as a weight, but the system of delivery uses volume occupied as the proxy measure. If the system isn’t calibrated for differing densities the amount of energy supplied can vary considerably.

Dry matter content. Most wheats purchased from registered dealers will have a DM content between 87-88%. However grain purchased directly off the header,

particularly in the high rainfall areas of Tasmania can be sold with DM as low as 84% particularly if it is known the wheat will be used immediately and not stored long-term. While energy levels may still be high, the change in DM will result in less energy being fed per volume.

Weed, insect and other contaminants. Wheats can have a variety of weed and insect contaminants that lower the overall quality of the concentrate. Mycotoxins in wheat supplied to dairy farmers cannot be excluded as a factor contributing to lowered milk yields. Feed contaminated with the mycotoxins Fumonism, Aflatoxin and Vomitoxin have all been shown to decrease milk production in dairy cows, usually by causing an overall reduction in feed intake.

Screenings. Grains can be sold with differing levels of screenings and grains purchased directly off a header may not have been sieved to determine the screening contents.

All the above factors, either singly or in combination, can affect how a cow performs on a concentrate supplement and any production decline arising from any of the above may have wrongfully been attributed to the variety of concentrate used.

Station 5

11:45am and 2:45pm

Dr Ray King
Dairy Australia

Feedgrain Partnership results on Wheat samples collected in Tasmania

For the past three growing seasons, wheat and barley samples were collected from across Australia by Denis McGrath, Executive Officer of the Feedgrain R&D Partnership. Samples were provided by commercial grain handling organisations, including TAP AgriCo in Tasmania. The NSW Department of Primary Industries feed testing laboratory at Wagga Wagga, completed the AusScan analysis on the samples collected. This analysis provided estimates of the energy content of the samples for various livestock, as well as the common analysis for nutrients such as crude protein, fibre and starch.

In 2015/16, sufficient wheat samples were collected in Tasmania which allowed a comparison of the nutritive content of samples collected from dryland or irrigated land, as well as a comparison between the different varieties, Einstein, Manning and Revenue. In each comparison, there was no effect of irrigation or variety on the nutritive content of wheat. There were some slight differences between year the sample had been collected (Table 1).

Table 1: Comparison of wheat samples collected in Tasmania from 2013-2016

Nutrient	2013/14	2014/15	2015/16
No. samples	7	46	40
Crude Protein (%DM)	11.2	10.0	10.5
NDF (%DM)	11.6	11.4	10.9
Starch (%DM)	70.9	73.0	73.8
Pig Energy (MJ DE/kg)	13.8	13.9	14.0
Chicken Energy (MJ AME/kg)	12.7	12.2	12.8
Test weight (kg/hl)	74.5	75.2	-
Screenings (%)	7.0	3.4	-

Overall, the composition of wheat samples collected in Tasmania was not dissimilar to those collected on the mainland. However, the amount of screenings appeared lower, and the variation in nutritive value between samples, if anything was lower in samples collected in Tasmania, particularly in 2014/15 when the amount of screenings in 46 samples ranged from only 1% to 6%.

One interesting analysis conducted on the wheat samples collected in Tasmania in 2014/15 was a theoretical segregation of the samples on the basis of starch and protein content, two of the most important nutritional values of wheat for

ruminants (Figure 1). Comparing a composite sample of the high starch/high protein grains (10.8% CP and 74.4% starch) with low starch/low protein wheats (8.6% CP and 71.1% starch), the difference in value between these two composite samples would be in excess of about $15.00 per tonne, in favour of the high protein/high starch grains.

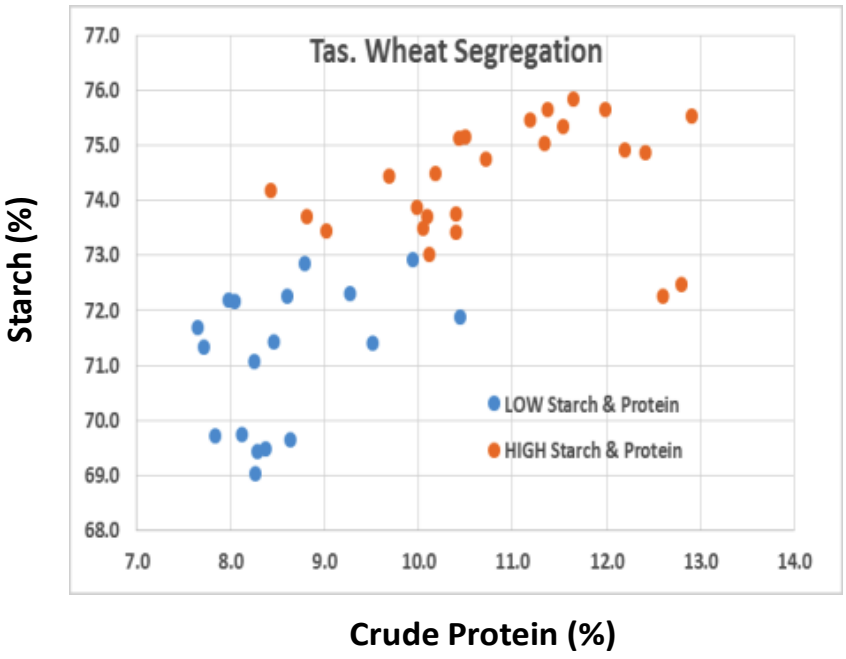

Figure 1. Starch and protein content of wheat samples collected in Tasmania from the 2014/15 harvest.

Station 6

12:15am and 3:15pm

Nick Pyke, Rob Craigie
FAR New Zealand

Advances in cereal grain productivity in New Zealand – towards 20t/ha by 2020

Learning how to get the best from early sown feed wheat

From 1999 to last season the average wheat grain yield in the NZ cereal cultivar performance scheme has increased from about 9.5 t/ha to 11 t/ha (Figure 1). The cultivar Claire has been in the scheme from 2000. The average yield increase of Claire has been about 70 kg/ha/year. This yield increase is mostly from improved agronomy e.g. earlier sowing. The difference between the yield increase of Claire and the average yield is a measure of how much progress has been made from breeding which works out to about another 20 kg/ha/year giving a total yield increase of 90 kg/ha/year.

Some growers frequently achieve yields of 15 t/ha plus. The Foundation for Arable Research has been running an ambitious research programme targeting a yield of 20 t/ha by 2020. The programme has now completed four seasons. In this research winter wheat crops sown in February and March have been compared to more traditional April plantings. Results to date have shown that crops planted in late March can be more productive than April sowings, but earlier March and February planting results in excessive growth, which “chokes” the crop causing a period of senescence in the winter and early spring as the excess growth rots away. This “transitory senescence period” rather than increasing light interception reduces it in the early spring nullifying any potential yield increase from earlier planting. Over the last season the research team have been exploring ways of manipulating the crop canopy to keep it greener through winter and spring including cultivar selection, plant growth regulator programmes and defoliation. The two slow developing cultivars Wakanui and Inferno were compared last season. For March sow dates the cultivars maintained similar canopy greenness and had similar average yields of about 16 t/ha. Although there was no yield difference between these two cultivars we believe germplasm more suited to early sowing may offer a way forward. For the 2016-17 season a range of cultivars selected by breeders and seed companies are being screened from an early March sow date.

Grazing is a way of utilising the extra autumn growth from the early planting as well as providing some disease and lodging control. Work at the 20 by 2020 site last season has shown that grain yield (16.7 t/ha) was maintained from a treatment that was mown in May and again in August yielding 2,500 kg of dry matter. The mowing treatment did not receive a PGR and did not lodge in a trial that had severe lodging.

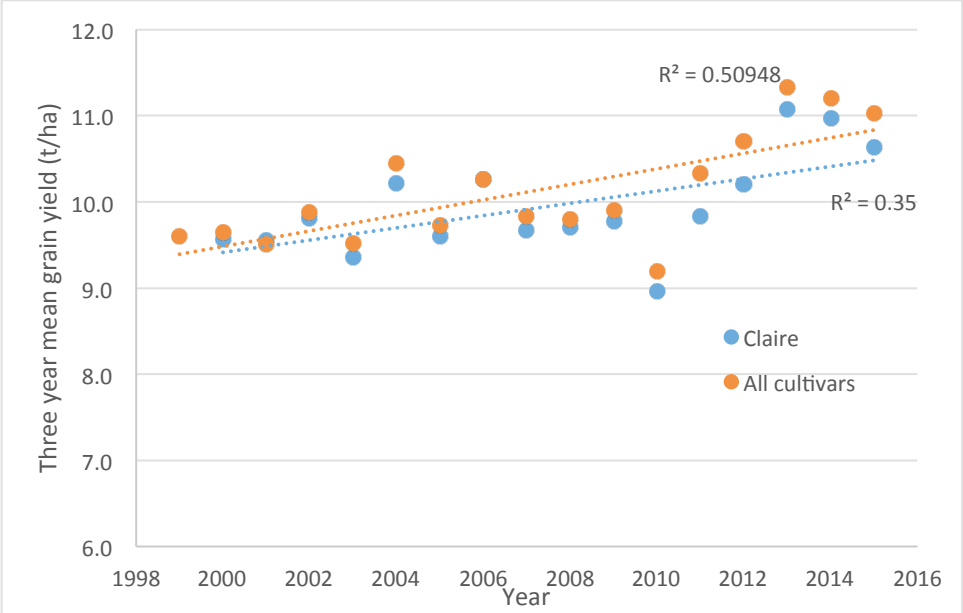

Figure 1. Three year mean grain yield of feed and biscuit wheat cultivars in the Canterbury trials of the NZ Cereal Performance Trial system (mean of irrigated & dryland trials for the 1999 – 2015 period).

Station 7

11:45am and 2:45pm

Jon Midwood
Southern Farming Systems

How can we use plant growth regulators (PGRs) to keep our crops standing when yields exceed 10t/ha?

Protocol 6. Wheat PGR Agronomy Trial

Output 2. B - Agronomy to support expansion of feed grain production in Tasmania

FAR trial code: FAR TAS W16-06
Protocol version: Version 1 (28.01.2016)
Location: Badcocks Farm, Hagley, Tasmania
Trial Treatments: 12 treatments
Trial Design: Randomised complete block
Time of Sowing: TOS 1 – April 7
Trial cultivar: Manning

Treatment List:

No.	Sowing Rate Seeds/m2	Rate	Timing
1	200	Moddus Evo 200mL/ha + Errex 1.3L/ha	GS31-32
2	200	Moddus Evo 100mL/ha + Errex 1.3L/ha f.b. **Experimental Trt 1**	GS30 f.b. GS32
3	200	Moddus Evo 200mL/ha + Errex 1.3L/ha	Autumn (6 leaf)
4	200	Moddus Evo 100mL/ha + Errex 1.3L/ha	Autumn (6 leaf)
5	200	Moddus Evo 100mL/ha + 1.0 L/ha of Errex f.b. **Experimental Trt 2** f.b. **Experimental Trt 3**	Autumn (6 leaf) GS31-32 GS37
6	200	Moddus Evo 200mL/ha + Errex 1.3L/ha **Experimental Trt 3**	GS31-32 GS37
7	200	Moddus Evo 100mL/ha + Errex 1.3L/ha f.b. **Experimental Trt 2** f.b. **Experimental Trt 3**	GS30 GS32 GS37
8	200	**Experimental Trt 3**	GS37
9	50	No PGR	
10	100	No PGR	
11	150	No PGR	
12	200	No PGR	

f.b. Followed by

N.B. The use of PGR active ingredients in this trial is experimental at this stage for research purposes only. The use of products in trial does not constitute a recommendation. Please seek advice from your agrichemical supplier before applying these products.

Station 8

11:15am and 2:15pm

David Skipper
Tasmanian Agricultural Producers

What cereal grains and quality do we need to grow the grains industry in Tasmania?

The Tasmanian cereal grain market is predominantly a feed market. Whilst malting barley has previously been the only human consumption cereal grain and was one sector that was up until 5 years ago a large user, we now see this sector diminishing to levels not formerly seen and are continuing to decline as the beverage market alters direction.

However, we are seeing increases in the use of local feed wheat and now milling wheats for flour production and high protein aqua feed. The local feed barley demand is still strong, whilst not increasing significantly it is a dominate product. Canola is making a significant comeback and the future is bright for this crop as local demand increases. This is great news for producers who have been seeking a break crop especially after a cereal or poppies.

The dairy industry is the largest user of cereal grains and manufactured product in the state. Dairy farmers who are users of cereal grains generally use 3 types of whole grains; wheat, barley or triticale. Understandably dairy farmers are driven foremost by price, quality and service and normally in that order. Over the last 10 years, Tasmanian dairy farmers have increased their use of supplementary feed and the shift away from barley and triticale to wheat, which has been profound and significant.

Dairy farmers have embraced the use of wheat as a supplementary feed source, and in particular ASW (white) wheat. There is no discernible or scientific difference between white and our local red wheat. However we do see that some of the local red wheats are lower in protein from time to time and from harvest to harvest.

The local preference for cereal grains, beginning with a white wheat with APW or ASW characteristics, a protein content of greater than 9.5%, very little husk, low screenings and a high test weight above 78%. Tasmanian barley quality is already of excellent quality characteristics and is well renowned for producing some of the plumpest grain with good to high protein content, and as this is local, it is less likely to contain weed seeds and other contaminants which are risks associated with imported grains.

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Station 9

10:45am and 1:45pm

Tracey Wylie, Nick Poole
FAR Australia

The importance of an integrated disease management (IDM) approach to disease control in Tasmanian cereal crops

Integrated Disease Management (IDM)

Achieving effective and cost efficient disease control in cereals is not a standalone debate based on fungicide application and which active to apply for a specific disease. An integrated approach to disease control takes into account all the measures that can reduce disease pressure and starts pre sowing. Applying the principles of IDM creates not only the opportunity to increase the profitability of the crop but also reduces disease pressure for the following seasons and helps prolong the life of fungicides available through fewer more targeted applications.

An IDM approach to disease control in cereals will be essential in Tasmania since a longer growing season and higher rainfall generates much higher disease pressure than on the mainland. Importantly this longer season results in more fungicide applications in the course of a season compared to mainland crops. Increased fungicide usage means that Tasmania is the most likely region to generate pathogen resistance to these agrichemicals. Adopting IDM will help reduce the number of fungicide applications and slow down the build-up of fungicide resistance. There are many factors to consider for successful IDM:

- Cultivar selection, look for the stronger resistance packages in cultivars adapted for your region based on diseases that are problematic in your region.
- Rotation position and stubble management, what inoculum has been left behind from the previous cereal crop? Is this going to affect the next crop, or the cereal crop over the fence?
- Sowing window, early sown crops are exposed to potential infection for a longer period, particularly in the tillering phase, so look to use more resistant cultivars for early sowing.
- The grazing potential of the crop; hard grazing in mainland research pre GS30-31 has been shown to replace the need for the first foliar fungicide for the control of leaf rust and septoria.
- When fungicides are used as part of IDM approach look to rotate between different modes of action and when disease pressure is high look to apply mixtures of different modes of action to prevent pathogen mutations building up.

Fungicide resistance

Tasmania is currently the only region in Australia where the Septoria tritici blotch pathogen has developed the R8 fungicide insensitive strain which differentially influences the performance of triazole fungicides. This strain has the same mutations as a strain identified in Europe and has greatest negative effect when tebuconazole is used and moderate effects when flutriafol is used. The R8 strain is present in the STB population on the Hyper Yielding site. The presence of this strain and the wet winter may explain the relatively poor control of STB achieved with flutriafol on the site, when assessed in SQP Revenue at GS31. At the 200g/ha active ingredient rate (full rate of the double strength) control on the lowest leaf assessed was 56% and only 6% at 100g/ha active ingredient (label rate for STB control). Flutriafol gave similar control levels of leaf rust assessed at the same time.

New fungicide active ingredients with different modes of action

In addition to adopting more genetic resistance growers are beginning to see the introduction of new modes of action, in particular the Succinate Dehydrogenase Inhibitors (SDHI's). The yet to be released foliar products proposed to be named Aviator Xpro and Ceriax are examples of new SDHI's (bixafen and fluxapyroxad respectively) mixed with triazole fungicides. In addition New Actives research conducted on the mainland and funded through the Centre for Crop & Disease Management (CCDM) and GRDC has identified useful control of STB with an experimental seed treatment, which at GS31 was giving 81% control on the lowest leaf assessed (F-5).

Station 10

11:15am and 2:15pm

Nick Poole
FAR Australia

Increasing wheat yields in Tasmania - how much can we do with agronomy versus germplasm?

One of the objectives of the Tasmanian Hyper Yielding Cereals project is to have 10% of wheat crops yielding 14t/ha by 2020! So how are we to achieve such an aspirational target? Broadly the focus of the research centre here at Hagley is addressing this objective under two major headings; firstly defining the potential of new feed wheat cultivars (germplasm) to deliver high yields in the Tasmanian environment, and secondly through new agronomy techniques. To fully explore the potential of new cultivars to deliver higher grain yields, 16 wheat elite cultivars provided by breeders are being grown under four management regimes against three feed wheat controls Manning, SQP Revenue and Beaufort.

Intercepting more sunlight to create more biomass

The research on wheat has been established at two sowing dates; 6th and 27th April. The earlier of these sowing dates has been set up to explore whether higher grain yields can be created with earlier sowing. The logic is that earlier sowing intercepts more sunlight, which in turn creates more crop biomass that gives rise to the opportunity for higher grain yields. Arguably early sowing is already widely established in the Tasmanian farming system due to its grazing potential. But can early April sowings based on the correct cultivars boost yields without being defoliated? The problem with early sowing and crops with higher biomass is that they are predisposed to greater disease pressure and greater lodging risk. In addition, if as a result of early sowing they develop too quickly then they will not for fill the potential of the earlier sowing date as the season length will not be extended.

Ideal attributes of cultivars to exploit early sowing windows (late March/early April)

In order to successfully achieve high yielding grain crops from early sowing cultivars must have three key attributes. These are i) excellent disease resistance to diseases prevalent in the region, ii) good standing power to support 12t plus grain yields and iii) a slower rate of development or phenology that better matches a longer growing season. Grazing wheat crops clearly assists with reducing disease pressure, improving standing and delaying development but could the dry matter removed by grazing be put towards higher grain yields if retained? Grazing and high input management without grazing are compared at the centre this season. Rarely is it possible to find new cultivars that combine these three attributes (disease resistance, standing power and the ideal phenology) and high yields. With Septoria resistance recent research findings from the John Innes Institute in the UK suggested

it may be difficult to achieve high yields and good resistance to this disease since modern UK cultivars were derived from a cross where these two traits were very close together, such that selections for high yield came with a penalty of Septoria susceptibility. Colleagues in the project will be covering the agronomy techniques in other sessions that may allow us to cover some of the weaknesses in cultivars that do not possess all three characteristics (Jon Midwood on PGR programmes for early sown crops and Tracey Wylie examining disease management strategies). Research so far has identified a small number of candidates that have similar phenology to Manning and SQP Revenue, good standing power and reasonable disease resistance when sown early. Harvest will inform us whether these candidates can also deliver grain yield.

Yield improvement based on lower input and a traditional sowing window.

The issue with moving sowing date earlier is that fewer and fewer cultivar candidates make the grade, so the other focus of research at the centre has been to explore the potential of 35 new coded wheat cultivars that might have high yield potential under a more “normal” feed wheat management in a traditional late April sowing window. Whilst the focus is still on high yield potential the project team is looking for high yield under standard rather than high input.

Station 11

10:45am and 1:45pm

Heather Cosgriff
Southern Farming Systems (SFS)

Maximising the yields and margins of barley in the Tasmanian environment

Key messages

- Variety choice is key - opt for best disease resistance profile and long growing season.
- Oxford (Feed) barley had highest yield of all varieties tested in 2013-15.
- Sowing rates of 180 – 220 plants/m^2 are suitable for crops under irrigation.
- Consider sowing malting quality varieties to maximise market access.
- Late nitrogen applications increase grain protein, potentially decreasing malting quality.
- Available soil nitrogen can significantly affect grain yield and quality. Consider taking soil core samples to test for nitrogen at depth before establishing a fertiliser regime.
- Application of PGR rarely increased yield in plot trials, but has improved/modified plant structure to reduce lodging.

Variety Choice

Westminster has replaced Gairdner as the dominant barley variety grown in Tasmania with the two major breweries, Cascade Brewery and Boags Brewery, endorsing it for malting, acceptability to the breweries is an essential consideration in deciding which variety to grow. Oxford Barley has shown the highest yield potential for early sowings. Low feed grain prices have been a driving factor in variety choice this season. See Table 1.

Seeding rate

In past trials sowing rate did not have an effect on grain yield, protein, test weight, retentions or screenings. Sowing rate did have a significant effect on tiller number, but all sowing rates achieved an equivalent number of heads at grain fill. See table 2.

Table 1. Barley variety grain yield and quality 2014.

Variety	Yield t/ha		Protein (%)		Test weight (kg/hL)		Screenings (%)		Plants/m^2	
Oxford	7.88	a	13.6	b	65.6	a	3.88	b	91	b
Granger	7.23	ab	14.1	a	63.8	b	3.71	b	221	a
Westminster	7.20	b	13.5	b	65.4	a	3.67	b	228	a
Gairdner	6.29	c	14.3	a	61.7	c	13.50	a	246	a

Table 2. Comparison of phenological characteristics of barley at different seeding rates 2013.

Sowing Rate	Plant count (no./m^2) 13-Jun-13	% plants emerged 13-Jun-13	Head count (no./m^2) 13-Jan-14	Tiller no. (no./plant*) 13-Jan-14
Low (180 plants/m^2)	157 c	87.2 a	1172	7.6 a
Std (250 plants/m^2)	196 b	78.4 b	1250	6.4 b
High (320 plants/m^2)	241 a	75.3 b	1187	5.0 c
Mean	**198**	**80.3**	**1203**	**6.3**
P-value	0.0001	0.0030	0.4306	0.0037
LSD	12	3.2	NS	0.9

Means followed by same letter do not differ significantly p = 0.05, NS = not significant. (Source: SFS Tasmanian Trial Results Books 2013, 2014)

Nitrogen strategy

From 2014-2015 trials it was found applying urea to barley at first node (jointing) rather than early tiller resulted in greater yield. Grain protein percentage increased with increased urea application late, as expected, but still fell within malting parameters at this site (max 12% grain protein).

Station 12

12:15am and 3:15pm

Panel Discussion

Increasing Cereal Productivity

Terry Horan, Roberts Limited

Patrick Stephenson, NIAB TAG, UK

Warren Darling, Cropping Farmer, NZ

Notes:

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