AUSTRALIAN GRAIN

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FRONT COVER

What part of the plant really delivers the goods?

The estimated contributions of various plant components to grain filling in Australia – the 'source and sink' – are often based on European studies. But local research suggests these estimates differ markedly in the Australian context with critical disease management implications. **See article page 6.**

Contents

Focus Sections

Southern Australia Focus

Covering cropping systems of Southern NSW, Victoria, South Australia, Western Australia and Tasmania

Northern Focus

Covering Northern NSW and Queensland

Editorial... Lloyd O'Connell

IT has pretty much slipped under the radar – and I'm sure I didn't hear too many champagne corks popping over the past few weeks – but the federal government's commodity forecaster has predicted that grain production in 2010-11 has been our most valuable ever.

Despite gloomy and largely misleading newspaper headlines and TV footage, Australia has just harvested a winter crop worth a record $12.2 billion and is staring down the barrel of a further $1 billion worth of summer grains production – a total gross value of $13.2 billion for the 2010–11 season.

This is more than 20 per cent higher than the nation has ever banked before.

Despite "we'll all be rooned" headlines during our recent very wet times in the eastern states, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) estimates we have just harvested around 42 million tonnes of winter grains. This is a 20 per cent increase on last season and is the largest harvest since 2003-04.

Persistent rains and flooding took a heavy toll on some individual farms but from a national perspective, winter cereal production has been excellent compared to recent drought-affected years.

Wheat production is estimated to have increased by 20 per cent on last season to around 26 million tonnes, barley is up 18 per cent to 9.3 mt and canola also enjoyed the ride and increased national tonnage on last year by more than 10 per cent to deliver around 2.1 mt.

The wet 2010 spring and harvest period for the eastern states took its toll on grain quality – but strong international grain prices have largely countered this.

The summer crop has bolted with excellent soil moisture, good rains and increased irrigation water allocations. Predictions are for a massive increase of more than 65 per cent on last summer to production of close to 5.0 mt.

Best in the world

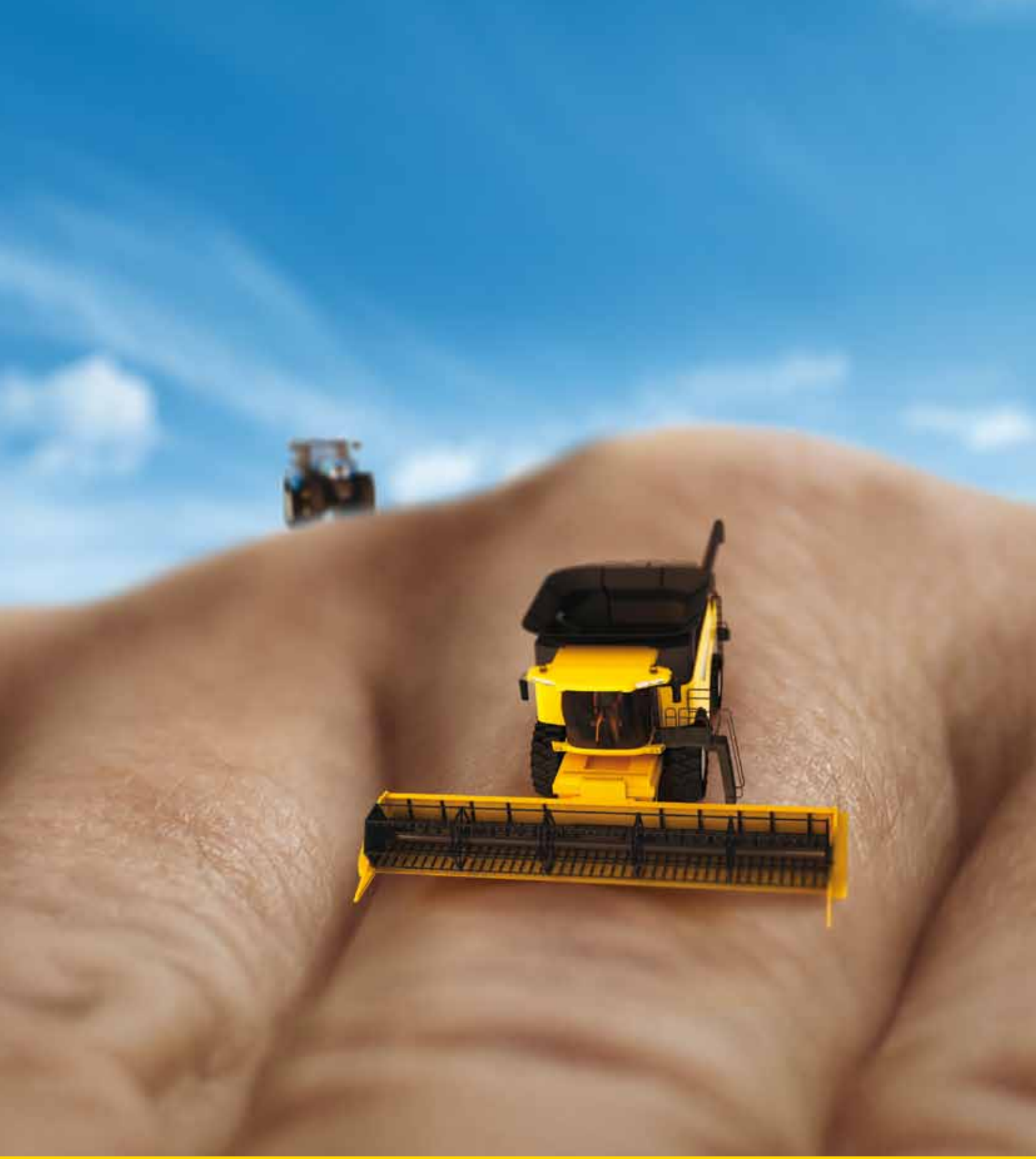
But like I said, I haven't heard too many corks popping in celebration of a remarkable season. In many cases the dampeners have been the nagging "one that got away" feeling tinged with "just imagine if the Aussie dollar wasn't so strong".

Highly variable seasons and volatile international currency markets are just some of the typical vagaries of the business of agriculture in Australia. Fortunately, Australia's farmers are the best in the world in dealing with them.

All the best for a 2011 season with fewer vagaries and more popping corks.

AUSTRALIAN GRAIN

In this issue...



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Own a bright future

Wet season tips for saving seed

SAVING viable grain seed for the 2011 winter crop following such a wet harvest period requires careful collection, storage, handling and subsequent planting.

Grains Research and Development Corporation (GRDC) northern panellist and cereal chemist, Jodi McLean, says retained seed must be graded and tested for germination and vigour.

"All crops are susceptible to deterioration in seed quality during wet harvests," Jodi said.

"Symptoms can range from mild – a loose and wrinkled seed coat, to severe – seed staining and fully germinated seed.

"It is essential to recognise whether the damage is cosmetic or the symptom of a seed-borne disease and if it will impact on germination."

Seed quality can also decline during storage and growers are advised to test germination capacity before and during storage, and before planting.

"Generally, a germination percentage of 80 per cent at planting is considered acceptable but when testing at harvest the germination percentage should be higher," Jodi said.

With many weedy pulse and cereal crops in a wet season, desiccation or crop topping is often necessary. Depending on timing and chemicals used, this could affect seed quality for sowing.

TOP TIPS FOR SEED RETENTION

- Ideally retain seed from grain harvested before rain.
- Weather damaged grain is more susceptible to poor germination, low vigour and degradation during storage and handling, so extra care is needed.
- Harvest at low moisture and cool temperatures. Storage temperature and moisture must be monitored and controlled.
- Germination percentage should be checked at harvest, during storage and before seeding. Low germination seed should not be used.
- Do not retain seed from hybrid canola.
- Correct seeding depth, conditions and agronomy are essential when sowing weather damaged seed.

Growers are reminded that grain must not be retained for seed when glyphosate has been used in pre-harvest applications.

"Achieving and maintaining low temperature, humidity and grain moisture content for stored grain is critical if grain has been weather damaged," Jodi said.

"As weather damaged seed deteriorates faster than sound seed it should not be stored for more than 12 months.

"A germination test can be carried out on stored grain one to two months after storing to reassess its viability."

Weather damaged grain is likely to have a lower germination percentage and poorer vigour, so seeding rates will need to be adjusted accordingly.

GRDC northern panellist and cereal chemist Jodi McLean says retained seed should be graded and tested for germination and vigour.

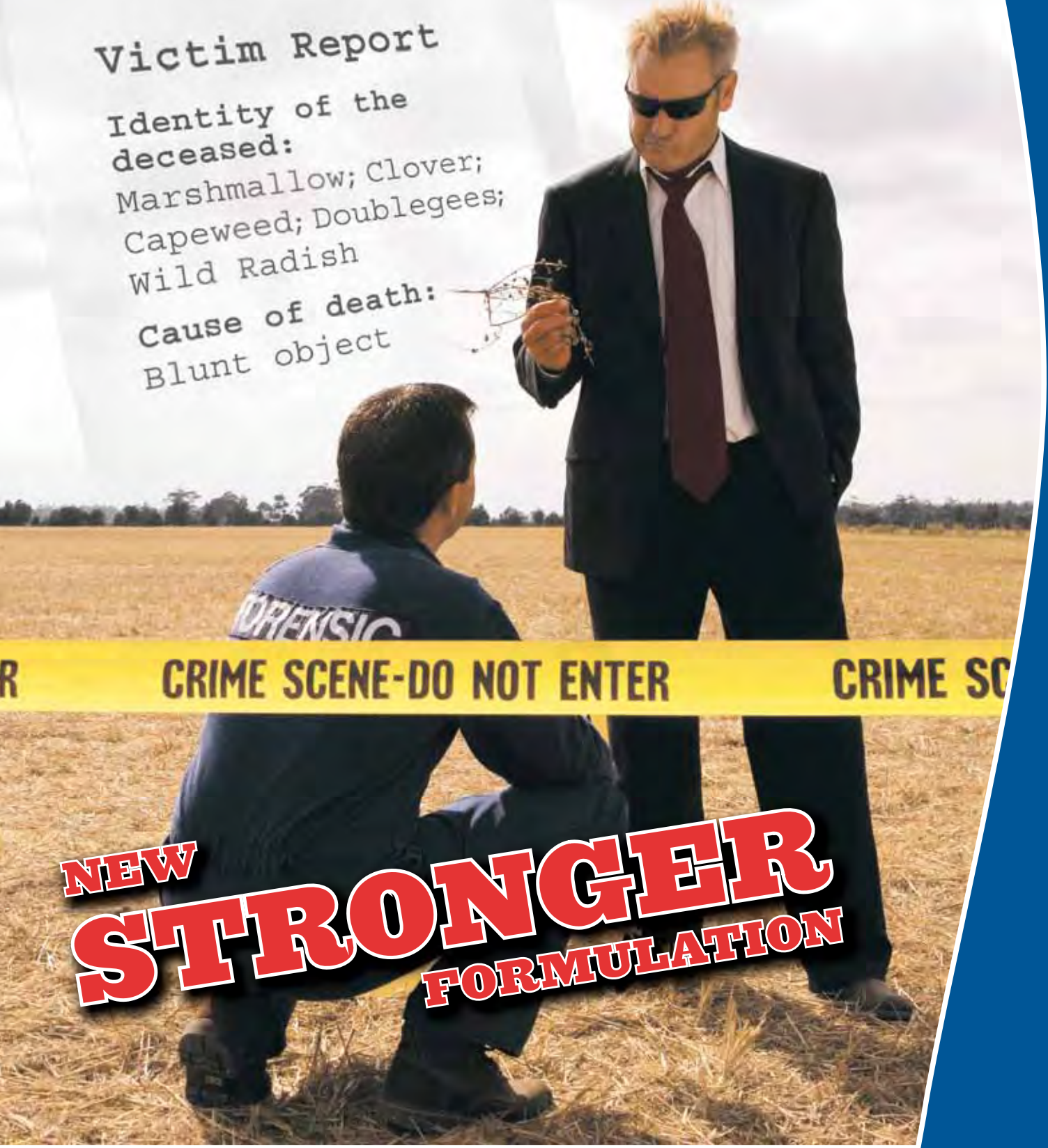
A laboratory seed test should be used to establish the germination percentage of on-farm retained seed before sowing, especially if it has been weather damaged. A vigour test is also recommended.

Purchased seed will be certified and should include details of germination percentage.

"It is essential that nothing impedes germinating seed to reach the surface and establish," Jodi said.

"Sowing too deeply, cold or wet soil, some seed dressings and herbicides and hard setting soil, can all reduce seedling emergence."

GRDC has released a fact sheet, Retaining Seed, outlining tips for saving seed and answering frequently asked questions. It can be downloaded from www.grdc.com.au/uploads/documents/GRDC_FS_RetainingSeed2.pdf ■



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Crop Care

Is it time for a 'source and sink' re-think?

By Alan Bowring[1] and Neil Fettell[2,3]

AT A GLANCE

- Current industry estimates of leaf contribution to grain filling originate from the UK, under conditions markedly different from Australian grain regions.
- Field trials using radio isotope carbon (^{14}C) and leaf desiccation methods suggest that the contribution of the flag leaf may be half the value currently used.
- Ear and stem photosynthesis appear to be of greater importance in Australia, as do water soluble carbohydrates stored prior to grain filling, particularly under post-anthesis water stress.
- Earlier disease management (tillering through to flag leaf emergence) might be more important than maintaining flag leaf area late in grain filling in this environment.

AN understanding of the physiology of crop growth and grain filling can help in agronomic management of cereal crops. In particular, foliar disease management can be enhanced by knowledge of disease severity and the economic benefit of spray timing in relation to the protection and retention of green leaf area.

With diseases such as stripe rust estimated to cost the Australian wheat industry $127 million annually, an understanding of the impact of leaf loss on yield is crucial. In particular, the estimation of individual leaf and stem contribution to yield plays a critical role in assessing potential economic impact and management decisions relating to disease control.

Grain yield can be considered as the balance between the supply of assimilates (carbohydrates, proteins etc) and the capacity of the grains to accumulate these assimilates – often referred to as the 'source' and the 'sink' respectively.

Assimilate supply for grain filling comes from concurrent photosynthesis by the leaves, stem and ear and from reserves in the stem and leaves which accumulate prior to grain filling. These reserves are primarily water soluble carbohydrates (WSC) stored in the stem and leaf sheath, as well as amino acids transferred from senescing lower leaves.

Sink capacity is determined by the number of grains per unit area and their potential size.

Improvements in grain yield over time have come mainly from increases in grain number per unit area, rather than in grain size. This relationship – plus evidence from sink-source manipulation experiments – suggests that where post-anthesis environmental conditions are favourable (cool, high daily radiation, no disease, adequate water and nitrogen), yields are limited by sink capacity rather than assimilate supply.

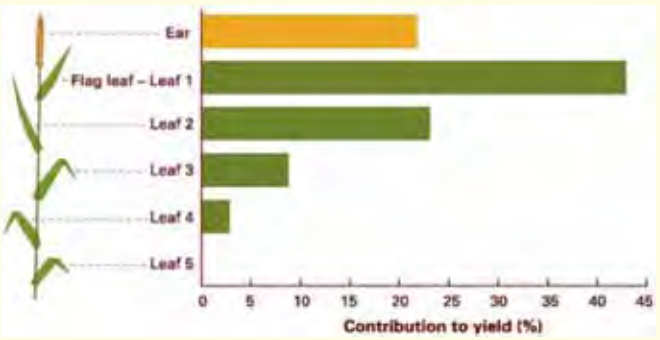
But these conditions are rare in the Australian wheat belt where grain yield and quality are frequently reduced by a lack of assimilates for grain filling.

The relative contributions of plant components to grain filling will impact on the response to the use of fungicides to maintain green leaf area. The yield contribution estimates used by industry in Australia are often based on North-western European studies (Figure 1) and therefore might be expected to differ markedly in Australian varieties and in the seasonal conditions experienced in the Australian grains regions.

These UK findings put a very high value on the contribution of the flag leaf but ignore the contribution from leaf and stem reserves.

This article reports findings from field studies using radioactive tracers and desiccation treatments to estimate the relative contributions of plant components to grain yield.

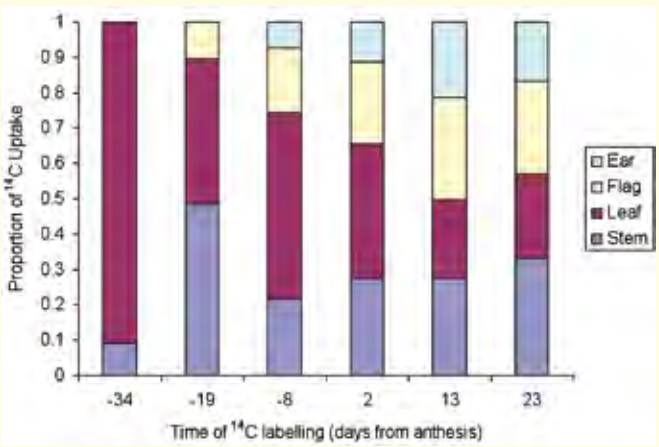
FIGURE 1: Current yield contribution values used by the Australian industry, based on UK estimates



Estimates based on isotope studies

An estimate of the relative value of the various plant components can be made based on the distribution of photosynthesis within the canopy. To do this, wheat plots at Condobolin in central west NSW, were enclosed in a chamber and fed the radioisotope carbon – 14 (^{14}C) on six occasions during crop growth. Uptake of the radioactive carbon was

FIGURE 2: Changes with crop growth stage in the distribution of photosynthesis (^{14}C uptake) within plant parts for wheat at Condobolin



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measured immediately after the 10 minute labelling period (Figure 2), 24 hours later, and again at maturity.

Some plots were given extra water to maintain the soil moisture deficit at less than 50 mm and the crop yielded close to four tonnes per hectare, others were rainfed and experienced mild water stress, reducing yield by one tonne per hectare.

At the first measurement date, 34 days before anthesis (flowering), stem elongation was just underway and hence 90 per cent of crop photosynthesis took place in the leaves. At later dates, once the stems elongated, the leaf sheaths were an important organ for photosynthesis. After anthesis, the contribution from the lower leaves declined and the ear became more important.

Water stress altered these values, and a comparison of the two water treatments for the post-anthesis period is shown in Figure 3.

Stress hastened the senescence of the lower leaves and, to a lesser extent, the flag leaf, reducing their contribution. The ear and stem became of greater importance, and these organs are known to better maintain turgor (normal structure) under water stress.

A similar response might be expected to foliar diseases such as stripe rust, which generally have a greater effect on leaves than on the stem and ear.

Tracer measurements at maturity showed that assimilates produced in all plant components after anthesis were equally present in the grain at maturity. Therefore, estimates equivalent to those from Europe (Figure 1) can be made based on the values for 13 and 23 days after anthesis, and these are listed in Table 1.

For the non-stressed crop, estimates for the ear contribution were similar to UK values, at about 20 per cent. But our Condobolin estimates of the flag (28 per cent) and lower leaf (23 per cent) contributions were much lower, mainly because of the contribution of the stem, comprising the peduncle and leaf sheaths.

Mild water stress also had a major effect, raising the ear contribution to 32 per cent and lowering the flag and lower leaf values to 20 per cent and seven per cent respectively, and increasing the stem contribution to 41 per cent.

All of the estimates above ignore the contribution to grain yield of assimilates produced prior to grain filling, and stored as

TABLE 1: Yield contribution by plant components in the UK compared to Condobolin for non-stressed and water stressed crops, without and with inclusion of pre-anthesis contributions

Component	UK data	Condobolin data			
		No reserves		With reserves	
		No stress	Stress	No stress	Stress
Ear	21	19	32	14	20
Flag leaf	43	28	20	21	12
Lower leaves	36	23	7	17	4
Stem	0	30	41	23	25
Reserves	—	—	—	25	39

FIGURE 3: Effect of water stress on the distribution of photosynthesis (^{14}C uptake) within plant parts after anthesis for wheat at Condobolin

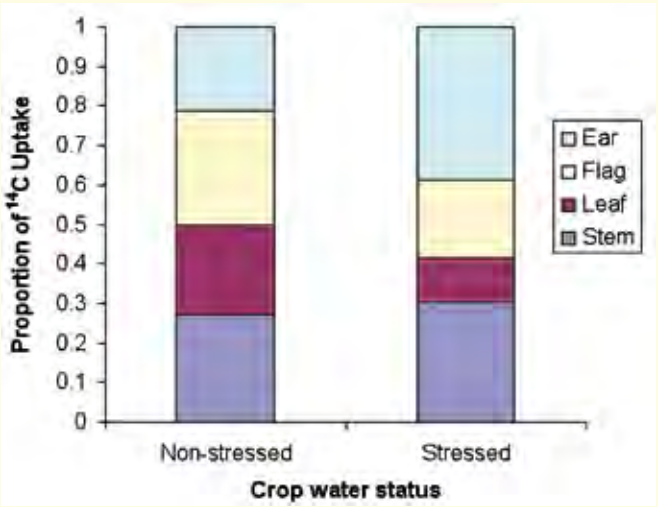


TABLE 2: Grain quality by desiccation treatment

Leaf treatment	Average grain yield (g/m²)	Average grain weight (TGW) (g)	Average harvest index	Average screenings (%)	Average grain number/tiller
NIL	401	31.60	0.37	4.7%	29
Flag	324	28.20	0.32	7.6%	26
Top 2 leaves of canopy	308	28.11	0.31	9.1%	25
P value (5%)	<0.001	<0.001	<0.001	<0.001	0.016
l.s.d (5%)	44.01	1.68	0.02	0.01	2.55
CV%	8.9	3.3	5.7	17.4	8.0

TABLE 3: Grain quality by variety

Variety	Average grain yield (g/m2)	Average grain weight (TGW) (g)	Average harvest index	Average screenings (%)	Average grain number/tiller
EGA Bellaroi	326	34.76	0.32	3.6%	25
Gladius	355	29.99	0.33	7.6%	27
EGA Gregory	354	27.16	0.34	7.2%	30
Sunco	342	25.29	0.35	10.2%	24
P value (5%)	0.510	<0.001	0.146	<0.001	0.019
l.s.d (5%)	1.20	1.53	0.03	0.02	3.42
CV%	48.82	2.6	2.4	8.7	4.6

WSC and proteins. In the Condobolin trial, these were measured using ^{14}C and measurements of WSC, and were 25 per cent and 39 per cent for the non-stressed and stressed crops respectively.

Including these values in the calculations (Table 1) reduces the flag leaf contribution during grain filling to 21 per cent without stress and just 12 per cent with water stress.

This study highlights the importance of ear and stem photosynthesis and of assimilate reserves for grain filling in the Australian environment, and a corresponding lower importance of late green leaf area. There may therefore be smaller responses to leaf disease control in the grain filling period than in other environments. But it is likely that the flag and the leaf immediately preceding the flag leaf (flag^{-1}) leaves are important in the critical periods of floret growth and flowering, when grain number is determined and stem reserves are accumulated.

Further work is required to determine if earlier fungicide application might be more important here than in some other environments.

Estimates based on desiccation

A more direct estimate of component contributions and source-sink balance can be made by surgical defoliation, shading and de-graining. But these techniques have limitations. Removing leaves changes the radiation profile in the canopy and may alter nitrogen relationships: shading affects the whole canopy including the ears and stems, and de-graining may change assimilate pathways or the hormone balance of the ear.

An alternative is to use a chemical desiccant, which interferes with photosynthesis but leaves the leaf in place and which is not translocated so that grain growth is not directly affected. Potassium iodide (KI) has been shown to have these properties and was therefore used in a number of field trials.

Following a study in 2008 into the estimation of yield components of wheat, a field trial was conducted in 2009 to further examine yield contribution values for the northern grains region. This trial utilised a range of commonly grown varieties. In addition WSC were measured to estimate the contribution of stem reserves to grain fill under conditions experienced in the northern grains region.

Yield contribution trial

Four varieties (EGA Gregory, EGA Bellaroi, Gladius, and Sunco) were treated with a chemical desiccant (1.5 per cent solution of KI) at the beginning of anthesis (GS61), treating either the flag leaf only, or the flag and flag^{-1}.

Grain yield was significantly reduced by the KI desiccation treatment in comparison to the untreated control, although no difference was found between treatment of the flag leaf alone, and the flag plus flag^{-1}. No significant differences were found between varieties.

Grain weight was reduced by leaf desiccation. The untreated control differed significantly from either leaf treatment, but the leaf treatments were not different from each other (Table 2). There were significant differences between varieties (Table 3), for grain weight. Varieties reduced in the order:

EGA Bellaroi > Gladius > EGA Gregory > Sunco

Harvest index differed significantly between KI desiccation leaf treatments. While both leaf treatments had lower values than the untreated control, no difference was found between the two KI desiccation leaf treatments (Table 2). There was no significant difference between varieties for harvest index (Table 3).

Screenings differed significantly for both leaf desiccation treatment and variety (but there was no interaction between the two). Both KI desiccation treatments significantly increased screenings compared to the untreated control, but differences between the two leaf desiccation treatments were not significant (Table 2). For varieties, screenings differed for all varieties with the exception of EGA Gregory and Gladius (Table 3). Varietal order of screening per cent was:

Sunco > Gladius = EGA Gregory > EGA Bellaroi

There were differences in the grain number for both leaf desiccation treatment and variety (no interaction). Grain number per tiller was reduced with both leaf desiccation treatments compared to the untreated control. But the difference between the two leaf desiccation treatments was not significant (Table 2). Varietal differences (Table 3) also existed, with grain number reducing in the order:

EGA Gregory > Gladius > EGA Bellaroi > Sunco

WSC concentration and content by leaf desiccation treatment and variety was assessed. For leaf desiccation treatment (Table 4), no significant differences were observed although both WSC concentration and content were higher when leaf desiccation treatments were imposed compared to the untreated control.

In contrast, significant differences were found between varieties, with WSC content reducing by a greater degree for EGA Bellaroi than EGA Gregory and Sunco. Gladius was not found to differ from any of the other three varieties (Figure 4).

The validity of current estimates of yield contribution values for wheat has been examined in the 2008 and 2009 season trials. Average temperatures and rainfall differed markedly between trial years. The common variety between years, EGA Gregory, was six days quicker in 2009 than in 2008 (39 days and 33 days respectively) for the period of anthesis to maturity. Over the entire season, 2009 was 42 days shorter in duration than 2008 (141 days in 2009 compared to 183 days in 2008).

The ability of a crop to reach its maximum yield potential is linked to season duration and photosynthetic area retention. The

FIGURE 4: Average WSC content (g/WSC/m²) reduction (anthesis to maturity) by variety

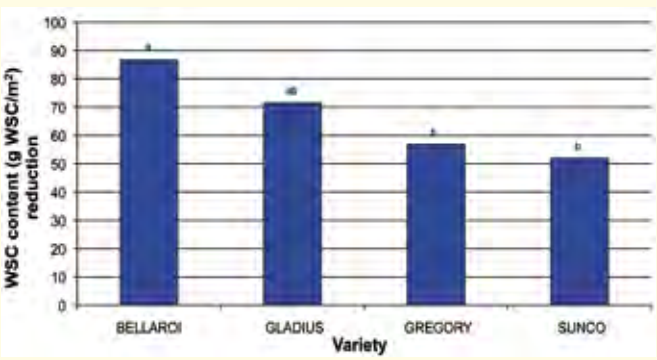


TABLE 4: Average WSC concentration, content and reduction (anthesis to maturity) by leaf treatment

Leaf treatment	WSC concentration (mg WSC/g DW)	WSC content (g WSC/m²)	WSC content reduction (g WSC/m²)
NIL	26.21	8.00	67.49
Flag	27.52	8.48	67.01
Top 2 leaves in canopy	31.53	9.88	65.61
P value (5%)	0.229	0.241	0.241
l.s.d (5%)	6.46	2.32	2.32
CV%	23.5	25.8	23.5

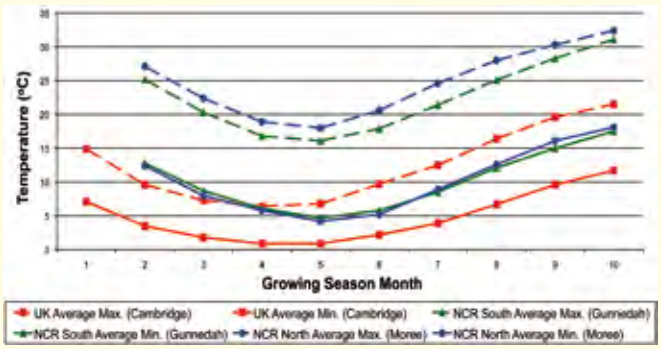
environment and foliar disease management play a significant role in reaching this potential. Industry utilised estimates of yield contribution from the UK differ markedly due to environmental and varietal differences.

A comparison between temperatures during the growing season for parts of the northern grains region and the UK (Figure 5) illustrate these differences and further support expected differences in contribution values.

To sum up

- Using desiccation over two seasons, the average contribution of the flag leaf to grain yield for the period of anthesis to maturity was determined as 23 per cent. This figure is similar to the values obtained using ^{14}C but is well below the current industry value of 43 per cent.
- The contribution of pre-anthesis stem reserves to grain yield was assessed by the reduction in WSC. Although no significant differences between treatments were found, a range of 16–21 per cent of grain yield weight was supplied by remobilisation of this fraction. Again, this value is close to that found at Condobolin using ^{14}C tracers.
- The importance of WSC and the contribution from the head and stem appear to be underestimated for our environment.
- The findings from these two approaches are consistent, and suggest that responses to foliar fungicide applied to keep the flag leaf green after anthesis may be smaller than expected, particularly if there is any post-anthesis stress.
- Further trials are needed to validate the values suggested in these trials, but this work suggests a review of disease management, agronomic and breeding programs may be needed if further results are consistent.

FIGURE 5: Comparison of UK, Moree and Gunnedah average maximum and minimum temperatures for the winter growing season



- Also, given the importance of the period before and during anthesis in determining grain number and stem reserves, studies are required to determine if earlier fungicide applications might be more appropriate for this region.

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■

Quest for wheat's Holy Grail

DROUGHT tolerance – it's the Holy Grail for wheat breeders and grain growers alike. The promise that a new variety could survive the ravages of Australia's notorious droughts and still deliver profitable yields has excited the imagination of every farmer across the country for generations, and yet it is still tantalisingly out of reach.

Such is the nature of the quest that progress is slow, a journey of small steps towards a milestone that is still at least a decade away.

"Thinking that we're going to find a single gene that is going to be able to produce 20 per cent more yield under drought is just not realistic," says Dr Ryan Whitford from the Australian Centre for Plant Functional Genomics (ACPFG) located at the University of Adelaide.

"It's a long, arduous process and it's about making incremental steps forward."

But the research is accelerating and tangible progress is being made in responding to an incredibly complex challenge.

With the support of the Grains Research and Development Corporation (GRDC), the Australian Research Council and international collaborators like the International Maize and Wheat Improvement Centre (CIMMYT), the ACPFG team has significantly advanced the understanding of the mechanisms behind wheat's ability to continue yielding under typically Australian drought conditions.

The strategy has involved a mixture of both traditional selection and breeding techniques, and modern biotechnology to try to identify the genes responsible for drought tolerance.

Making our wheat varieties more drought tolerant is an extremely complex breeding challenge but progress is being made.

Making the task more difficult is the genetic variation within the wheat species – there are many different parts of the plant that can contribute towards drought tolerance, and their action varies according to the variety and the seasonal conditions.

For example, transpiration strategies can vary from plant to plant, with one plant either extracting water from the soil very efficiently and another blocking the loss of water from the system.

Complicating the problem further is the fact that the wheat genome – 40 times larger than the rice genome – has not yet been fully sequenced.

Approaching the problem from one side of the equation with traditional forward genetics techniques is Dr Delphine Fleury, while her colleagues Dr Sergiy Lopato and Ryan work from a reverse genetics angle as part of the ACPFG's partnership with DuPont Agricultural Biotechnology.

Traditional techniques

Delphine's work stems from an elite germplasm program which began in 2003 in conjunction with breeding company Australian Grain Technologies (AGT) and tested varieties already known to be relatively drought tolerant.

They recreated the southern Australian drought cycle in which plants only have a short window to make use of available moisture before the soils dry out and before the cycle starts again with the next rain event.

The researchers studied the molecular and physiological mechanisms – such as tillering, root depth, transpiration rates and chlorophyll levels – in the parent lines Kukri, Excalibur and RAC875.

In the severe 2006 drought Excalibur and RAC875 were consistently 16 per cent and 22 per cent higher yielding than other varieties at the trial sites. Yet the three parent varieties all displayed different strategies in responding to the drought pressures.

For example, RAC875 proved to be very robust from planting, setting itself up before the season dried out, whereas Excalibur would set a lot of tillers early and then adapt its grain set according to the availability of water.

"It was really interesting to see that both lines that were tolerant were behaving differently," Delphine said. "It means that if we can identify some genes and combine them in some other cultivars we might be able to step up their levels of tolerance."

The process is underway again with the testing of cultivars Gladius (a cross descended from both Excalibur and RAC875) and Drysdale as drought-tolerant parent lines. These lines have different root systems and yet both yield well under drought – the question is which plant mechanism is driving that performance.

Following glasshouse and field trials here in Australia and in Mexico, the researchers set out to find the loci (sections of chromosome containing hundreds of genes) responsible for the plants' performance under drought conditions.

It was a massive task of crossing the parent lines – producing 3000 plants from each cross – in order to study the segregating population.

Narrowing the search

Assisting the process is the Plant Accelerator at the University of Adelaide, which uses high-tech digital devices to monitor plant development over time under the drought conditions. This speeds up the process of identifying the plants carrying the active genes. By comparing the structure of the different plants, researchers can narrow the search for the location of the key genes.

From the initial trials involving Kukri, Excalibur and RAC875, the team has identified four loci "that were really key in controlling the yields in drought conditions, so now we are in the process of trying to identify the genes behind them". Each locus has been linked to different plant responses to different drought stresses, including lack of water, heat and canopy temperature suppression.

"There's already nice progress, and we're getting closer to identifying one of the genes," Delphine said.

From one of the loci, the team has a candidate gene, with tests being prepared to validate the hypothesis, while the group is still in the process of mapping the genetic locations of the other two loci.

"Now we have a good understanding of the stress response of the parents at the molecular level, we have identified some key loci, and we're also strongly involved in wheat genome sequencing," Delphine said.

"It's still difficult because the wheat genome is a big genome and very complex. But with the new technology for genome sequencing we are starting to see light at the end of the tunnel.

"We are now going through a key phase of the project where we can start to put things together."

Modern biotechnology

It is at this point that Delphine's work converges with Ryan's and Sergiy's – they use modern biotechnology techniques to drill down and modify the individual genes that are identified in Delphine's work.

"We pull multiple lines of observation together; it's an integrative process," Ryan said. "Our biotech side looks at the gene sequence and individual genes. We can then cross-reference those two data sets."

In conjunction with DuPont Agricultural Biotechnology, Ryan

is working with some newly located genes to better understand how plants respond to drought.

"The genes we're looking at are responsible for several critical biochemical pathways that allow the plant to respond to stress," he said.

The goal is to identify naturally occurring genes that influence drought tolerance but are not being effectively utilised. Through the use of genetic modification (GM) techniques, the action of these genes is modified to bolster performance.

But the strategy runs the risk of what the scientists refer to as deleterious pleiotropic effects – the situation where modifying a single gene can create a ripple of unwanted physiological activity throughout the plant. For example, increasing the expression of a single gene which influences transpiration could then affect the time of flowering or grain set.

Eliminating unwanted effects

"We put a lot of focus on basically trying to eliminate the unwanted effects of modifying the genes," Ryan said. "We want the genes only to take effect when the stress is present."

"We need to know when each gene is turned on and off, and we need to fine tune that so it goes on and off at exactly the right time."

To address this problem Sergiy is trying to identify gene 'promoters', which provide the internal signals that activate the necessary genes to respond to the drought stress.

Additionally Sergiy's research has found a number of other factors – known as the DREB and CBF factors – that regulate the activation of key drought-tolerance genes.

"These gene switches activate a swathe of downstream genes and turn them on. We're trying to make sure these activate at the right time and in the right place," Ryan said.

By using transgenic methods to include these factors into crossbred lines, the performance of plants under drought stress was transformed, often leading to stunted growth as the plants decrease water consumption and conserve energy.

But in one series of trials transgenic plants containing the DREB factors were found to show no signs of stress for at least two to three days longer than control plants, and to be able to fully recover within one to two weeks of re-watering unlike most control plants.

Interestingly, the DREB factors were also linked to improved frost tolerance.

The end goal is to breed varieties carrying multiple genes that govern different plant mechanisms for drought tolerance.

Multiple genes

"There's no single gene that's going to provide a panacea to our drought problems," Ryan said. "We're trying to cherry-pick the various mechanisms and recombine them into one elite cultivar – and that process doesn't necessarily need to be GM."

The whole process of breeding for enhanced drought tolerance takes many years. The time from when a gene is first identified until it is incorporated into adapted varieties can take anywhere between five and eight years. These lines then need to feed into the breeding programs and can take a further 10 years before commercial varieties are available to growers.

The end result will not be a silver bullet variety that lifts yields under all growing conditions – drought tolerance breeding will deliver farmers an extra form of insurance against yield loss in dry seasons.

In the meantime though, as the researchers progress along the winding road towards this Holy Grail, the genetic material and knowledge is being shared with Australia's plant breeding companies, so that continual and incremental gains can be delivered to farmers. ■

On the path to better water use efficiency by plants

RESEARCH by University of Warwick's School of Life Sciences in the UK has opened up a new path to produce water efficient seeds that will be a significant tool to cope with drought resistance, and ensure global food security.

The research not only provides the best map to date of the key protein that appears to be the principal gateway for water intake during seed germination – it also actually provides the right map as it appears much of the research to date was focussed on a much less relevant protein.

The research team led by Dr Lorenzo Frigerio looked at two proteins that are members of the large family of 'Major Intrinsic Proteins' (MIPs), which are widespread among living organisms and are known to act as water channels governing water uptake.

The first of the types of protein they looked at PIPs – are intrinsic proteins that take the P at the start of their name from being normally found in the 'plasma membrane', the outer casing of a cell. Because of their normal position on this outer covering these plasma membrane (PM) intrinsic proteins (PIPs) have received much of researchers' attention as the probable prime gatekeepers of the water transport into and out of cells.

The UK researchers focussed much of their attention on a second group of intrinsic proteins known as 'Tonoplast Intrinsic Proteins' (TIPs) as they are most usually found in an inner cell layer called the tonoplast which surrounds a vacuole in a cell (vacuoles are enclosed compartments in a cell filled with water and containing inorganic and organic molecules).

Despite the fact that the TIPs appear to be able to govern water uptake, the fact that they are seen as being concentrated in the tonoplast has reduced researchers' interest in them as key players in water uptake. This is because the tonoplast itself is generally not considered to present a major problem for intracellular water flow, as its water permeability is thought to be much higher than that of the outer plasma membrane.

This has led to a concentration of study on PIP rather than TIP and meant that virtually nothing was known about how TIPs acted in processes such as seed maturation and germination.

The crucial water manager

The University of Warwick's research team work not only resulted in the most complete plant TIP expression map produced to date – it also threw up a major surprise in that they found that TIP not only had a role to play in water management in seed maturation and germination – in fact they found that it probably plays the crucial water management role, as PIP was almost literally nowhere to be seen.

As PIP, but not TIP, are generally found at the plasma membrane of plant cells, one would expect the involvement of PIP in seed de/rehydration. But the Warwick researchers found that – out of 13 PIPs encoded by the Arabidopsis genome – only three seemed to be detectable in their seeds. They also found that those three PIPs did not show up until 60 hours after germination. That is, only after the end of the most important phases of water uptake in a germinating seed.

In contrast the researchers found that very high levels of TIP3 protein appeared to be present in the plasma membrane during seed development and germination.

Lorenzo's working hypothesis is that TIP3, besides residing in the tonoplast, is recruited to the plasma membrane to compensate for the absence (or very low concentration) of PIP.

On the right path

We are now on the right path to build a real understanding of how water uptake is regulated in seed development and germination. That understanding will help researchers produce seeds to meet the challenges of changing climate, and food security through improved drought resistance and increased water use efficiency.

For further information contact: Peter Dunn, Email: p.j.dunn@warwick.ac.uk ■

Researchers have discovered the important water management role a previously overlooked group of plant cell proteins play in water use efficiency. This finding will open up a new breeding path for more drought resistant crops.

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Plant genes are the key to salinity fight

THE scourge of salinity has long been associated with the shocking images of wide stretches of farming country turned white from salt.

What is less recognised is that this spectacular damage is not the greatest threat salinity poses to Australia's grain crops – it is the low lying salts hidden in the water table beneath the soil surface which are doing the greatest damage.

"Salinity is a big problem nationally, but a lot of it is not the spectacular stuff like you see in places such as Western Australia where there are localised highly saline patches – that's a land management issue and there's good people doing excellent work on that," said Professor Mark Tester, from the Australian Centre for Plant Functional Genomics at the University of Adelaide and Director of the Australian Plant Phenomics Facility.

"Where there's a bit of salt in the soil and the yield is getting clipped back a bit – this is a very widespread problem.

"It's estimated about 70 per cent of the wheat crop around Australia has its yield pegged back by maybe 10 per cent."

And, unlike the salt scourges in WA, it's not huge amounts of salt doing the damage. Mark says just 'modest amounts' – salinity at just one-tenth the strength of sea-water – is all that's needed to start reducing plant yield.

What makes the plant tick?

But not all wheat varieties are affected in the same way. Mark and his team are working their way through the problem of what makes a wheat plant tick, what parts of the plant are active in resisting salt, which parts are susceptible, and which genes trigger those behaviours.

"What we've been doing is trying to understand the traits in plants that can contribute to maintaining yields in saline environments," Mark said.

"The yield that is being nipped back over a large area of land is because of salt that is down in the subsoil – you can't see it at the surface. That kind of subsoil salinity is a classic target for crop improvement – trying to improve the ability of plants to withstand that erosion to its yields."

It's not a problem exclusive to Australian conditions – salinity affects approximately five per cent of the world's cultivated land and represents a major limitation to agricultural production at a time when primary production needs to lift its output to meet the globe's growing population.

Big advances in recent years

But great leaps forward have been made in addressing the problem in recent years, with scientists around the world improving their understanding of which genes are responsible for the reaction of various crop types to salt pressures.

Here in Australia, Mark's work is being supported by the Grains Research and Development Corporation (GRDC), which is investing in pre-breeding research to discover novel genes and deliver germplasm with improved salinity tolerance to plant breeding companies.

These companies can then breed new and better varieties of wheat seed for sale to farmers, who can then grow higher-yielding crops on salt-affected lands.

It sounds like a simple proposition, especially in an era of gene markers and new plant monitoring technology, but the reality is highly complicated.

Australia's salinity research is not just about minimising the spectacular white surface patches on some of our farming lands. Crop yields are being reduced by more modest amounts of salt beneath the surface but recent research is making great progress in addressing the problem.

There are three components of a wheat plant that can help the plant maintain growth in saline soils:

- Its ability to keep salt out of its central shoot;
- The ability of the shoot to tolerate the salt that does enter (tissue tolerance); and,
- The ability of the plant to handle the negative impact salt has on water availability in the soil (osmotic tolerance).

Plant's ability to exclude salt

For the past decade Mark and his team have been working on the first element in trying to identify which genes govern a plant's ability to exclude salt from its shoot.

Mark's team has been investigating the HKT group of genes, which control sodium influx into cells, and some of which are located around the xylem (the pipes that move water through the plant).

In effect, the genes govern the ability of the xylem to suck the salt out of the water before it reaches the leaves.

"It's like the final purification of water before it gets to the leaves," Mark said.

Researchers at the CSIRO have located two of these genes in a single durum line, which provides big breeding possibilities given that most durum lines are very sensitive to salt.

And while the CSIRO has been crossing these genes into durum and bread wheats, Mark's team has been further investigating the genes' mechanism of action.

Through the use of transgenic techniques, the researchers are deliberately over-expressing the HKT genes around the xylem vessels to increase the variation beyond what is found naturally.

"The aim is make plants more tolerant by taking a beneficial trait and increasing its influence," Mark said.

This approach can result in what scientists call the 'deleterious pleiotropic effect' – where the increased expression of one positive gene trait triggers a corresponding expression of negative traits – Mark says that in this instance the other genes activated by the HKT gene group were consistent with the needs of the plant.

The research has found that over-expression of the HKT group led to improved sodium exclusion (up to 37 per cent less salt in the shoot) and salinity tolerance, with the excess sodium excluded from the shoot stored in the cortical cells of the root.

But more importantly to farmers, plants carrying the HKT gene

have been found to result in seedling biomass that is 10 per cent higher under saline conditions than lines not carrying the genes.

Two intervals in the wheat genome that include members of the HKT group – on the 2A and 6A chromosomes – have now been associated with that result, with 2A the most promising for further breeding work in bread wheats.

Barley gene shows promise

But Mark has not invested all of the industry hopes in just one project, with other areas of investigation also showing promising results.

"I like running quite a lot of programs in parallel and then jumping on the winners – which is a strategic way of operating," he said.

Some promising results have also been achieved in field trials following the identification of an influential area on chromosome 1 of barley known as HvNax3.

Due to their similarities, the location of key barley genes can act as a guide to the location of similar genes in wheat varieties.

But the challenge for researchers is that the HvNax3 interval contains hundreds of genes.

"Within that is one particular gene that in model systems has shown to influence salinity tolerance," Mark said.

"There are loads of genes that we don't know the function of, a whole pile of mystery genes, so it might be one of them.

"But we've spotted in that list of genes down the end of the chromosome an old friend that has already been published in model systems. So we decided to concentrate on this one."

So far, trials have shown that HvNax3 reduced shoot sodium accumulation by 10–25 per cent in plants grown in one-third seawater.

Interestingly though, the researchers are not certain of how the gene works, with Mark speculating that it might help the plant lock salt away in the roots, preventing it from rising up to the shoots.

"We're still not certain of the actual mechanistic basis for that trait," he said. "But if the field trials that we were doing this year confirm what we found in the previous year, then there are possibly big effects on yield from this particular chromosome interval.

"But I want to see those results come in for a couple of years yet before getting really excited about it."

The gene group has been bred into a number of recombinant crosses, involving the South Australian barley cultivar Barque, and if the next round of field trials replicate the early success in bolstering yield in saline conditions, Mark says numerous opportunities will ensue for identifying the differences between salt-tolerant and insensitive lines.

Stacking the tolerance traits

In the long-term Mark believes that numerous traits for salinity tolerance will be stacked into wheat varieties to dramatically improve performance.

"While we're delivering those sodium exclusion discoveries into the farmers' fields, in parallel with that we've got to start making other discoveries on other aspects of salinity tolerance," he said.

"The obvious ones we're chasing are osmotic tolerance and the tissue tolerance so we can pile these things on top of one another. The more information you have and the more useful it is, the more accurately we can alter traits out in the field and deliver more benefits to farmers."

More information on salinity is available at www.grdc.com.au ■

Variety Central to get to the End Point

AN online resource targeted at Australian grain growers has been developed as a central point for information regarding plant breeding, seed commercialisation, varieties, royalties and additional related matters. There will be a special focus on the End Point Royalty (EPR) system and processes involved with collection of royalties.

The website will be titled *Variety Central* and will be online at www.varietycentral.com.au from April 1.

Currently, the level of acceptance and support of the EPR system is highly varied within the grains industry. Whilst many growers understand the need for breeding systems to be supported through the implementation of EPRs, there are a number of other growers and industry participants who do not comprehend the necessity or value of the system.

Kate Lang is one of 14 participants in the 2010–11 Australian Future Grain Leaders Program.

In the most part, it is the lack of understanding of the drivers and benefits of the system that lead to these negative perceptions. Negativity toward the EPR system can lead to a number of detrimental outcomes including poor compliance levels with respect to declarations and payment of royalties.

This then places strain on plant breeding organisations to fund future breeding programs to produce new and high quality varieties.

At present, there is no centralised point of information regarding royalties available on the internet. You need to check with numerous different sources, where consistency and accuracy of messaging becomes unpredictable.

Central reference point

Variety Central will provide a central point of reference for up to date information on important variety related matters, including EPRs.

Variety Central will be sponsored by the EPR Steering Committee including, AGT, AWB Seeds, Intergrain, Grainsearch, Monsanto, Nuseed, Seedmark and Viterra. A number of industry organisations will also be supporting the website.

Variety Central has been developed by Kate Lang as part of the Australian Future Grain Leaders Program, sponsored by the Grain Growers Association. Kate is one of 14 participants in the 2010–11 program, which requires participants to complete an industry related project. Undertaking this project helps to develop young leaders within the grains industry. The program will conclude in July 2011 at the Australian Grains Industry Conference.

For more information: Kate Lang E: kklang@monsanto.com Ph: 03 9722 7173. ■

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The effects of rising temperature on wheat growth and yields

■ By Dennis O'Brien, Agricultural Research Service – USDA

INCREASING temperatures can drastically reduce crop yields, make irrigation a necessity, and increase the threat of drought. So for farmers around the globe, a changing climate is a major concern. Agricultural Research Service researchers at the US Arid-Land Agricultural Research Center in Maricopa, Arizona, have been helping growers prepare for the changing times by turning up the heat in experimental wheat fields to levels anticipated by 2050.

"No one knows exactly how changing conditions will affect yields in the decades ahead, and we're trying to give growers an idea about what they might expect, and how they can address warming issues and minimise losses," says Bruce Kimball, a retired ARS soil scientist who was the project leader.

In Arizona, wheat is normally planted in midwinter. It is harvested in late May and irrigated throughout its growing season. Temperatures can range from below freezing in winter to above 100°F (38°C) in May.

Bruce, ARS plant physiologists Gerard Wall and Jeffrey White, and agronomist Michael Ottman of the University of Arizona planted wheat every six weeks in separate plots between March of 2007 and May of 2009. They applied heat to six of the 15 plantings, warming the crops that were planted in March, September, and December. They measured canopy conditions to make sure temperatures in the heated plots rose by 2.7°F (1.5°C) in the daytime and by 5°F (2.8°C) to 6°F (3.3°C) at night. They call the effort the 'Hot Serial Cereal' project because they grew wheat in a series of plantings and heated the plants as they grew.

To warm the plots, the researchers used six 1000-watt infrared heaters suspended above the plants in a hexagonal pattern, forming a temperature free-air controlled enhancement (T-FACE) apparatus. Developed by Bruce, T-FACE enables scientists to raise the temperature of experimental crops in open fields. The technology is also being used by ARS researchers on grazing lands in Wyoming and soybean fields in Illinois and by more than a dozen other research groups around the world.

The researchers measured growth, yield, and several other soil and plant physiological variables. As expected, the heaters accelerated growth, increased soil temperatures, reduced soil moisture, induced mild water stress on the crops, and had a nominal effect on photosynthesis.

Yield effect depended on planting time

But effects on yields depended on when the wheat was planted. When heat was applied to wheat planted normally, in midwinter, its growth cycle was ahead by a week. There were no major differences in yield.

Adding heat to wheat planted in March reduced yields by half.

Most surprising, rather than reducing yields, adding heat to wheat planted in September protected the plants from damaging frosts between Christmas and New Year's both years. Heated plots showed only moderate yield loss, whereas the wheat in the unheated control plots yielded nothing.

The results may provide guidance for adjusting planting schedules as the climate warms. The researchers are developing computer models that could be applied to any region, making the results useful for adapting planting schedules to changing climates worldwide.

Contact Dennis O'Brien, USDA-ARS Information Staff, 5601 Sunnyside Ave., Beltsville, MD 20705-5129; (+1 301) 504-1624. ■

Aerial view of the Hot Serial Cereal experiment shows the effects of turning up the heat on wheat. The three lightly shaded strips of wheat in the centre were planted in September 2008 and were each divided into three plots: a heated plot with a heating apparatus (shown as a white panel), and reference and control plots where no heat was applied. Wheat in the heated plots, shown as circular patches near each heater, has already been harvested because it grew faster and matured earlier than controls. The dark-green plots on the sides were planted at other times in 2008 and 2009. (PHOTO: Thomas Clarke)

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Tractor loader/backhoes remembered – Part two

By Ian M. Johnston

The saga of Ian's experiences as Sales Manager of Lough Equipment Pty. Ltd. and the big Whitlock loader backhoes continues, with a new challenge on the horizon. Its name was JCB!

JCB

Following their perusal by Eric Lough, the 1964 editions of the British construction equipment magazines routinely found their way onto my cluttered desk. For months we had been noting the dramatic escalation throughout the UK and Europe of the promotion and resultant rampant marketing penetration of JCB loader backhoes.

We also noted that JCB had embarked on a global expansion of establishing importers in North America and the Asia Pacific region. Rather ominously we also detected that Whitlock sales nose dived wherever JCB established a toehold.

So who and what was behind this JCB phenomenon?

In 1945, Joseph Cyril Bamford constructed a farm trailer in his tiny lockup garage, using steel sheeting that had been part of an air raid shelter, which he welded together with a second hand 50 shilling welder! He presented it on market day in his Staffordshire village of Uttoxeter and sold it to a local farmer for the princely sum of £90. Over the next few hectic years of manufacturing, firstly in a coal yard and then in an abandoned cheese factory, his range expanded to front end loaders fitted mainly to Fordson tractors. In 1953 the first JCB loader backhoe was unveiled.

By 1964 JCB backhoes were the world's number one in the sales charts! A phenomenal achievement unparalleled in the construction machinery industry. Joseph Cyril Bamford was a truly remarkable entrepreneur!

A new direction

Back at Artarmon, Eric Lough was rightfully concerned that one day soon, JCB loader backhoes would appear in Australia and this could decimate our Whitlock sales. Therefore with considerable vision and (dare I say) cunning, he surreptitiously put out feelers to JCB in England.

In point of fact, we had been becoming increasingly disenchanted with our Whitlock franchise. Eric Tittley, the Australian Whitlock factory representative had his office at Dooralong, of all places! In 1964 the Dooralong telephone exchange only functioned a few hours each day. Even in the dedicated 'open' hours, if the exchange lady happened to be out feeding the chooks or had fallen asleep while watching a repeat of Dragnet, then Mr Tittley was off the radar.

Not a happy situation, as all communications with the factory had to be channelled through him. Accordingly, being unable to contact Mr Tittley could prove extremely frustrating, particularly if he was urgently required by Gib Gospal, the Lough service manager, to send a cable to the UK to chase up a rapidly mushrooming log of warranty claims, or to locate a missing consignment of desperately needed spare parts.

Harry Wilson was the JCB Marketing Director. In response to a letter from Eric Lough, he had cabled ahead and set up an appointment to meet us at Artarmon. Following a round table discussion, we knew he was our type of individual. We warmed to his ready smile and were impressed by his grasp of the construction equipment situation in Australia, even though this was his first visit to the Antipodes. His enthusiasm for the JCB product was persuasive and infectious. Further, he was not a prevaricator, but obviously a man of rapid decision.

I cannot recall the actual time frame involved, but in due course a franchise agreement was signed with JCB. Cartons of lavish brochures and promotional material began arriving. These had to be hastily hidden away in the back room if Mr Tittley was due to arrive, as no announcements had been made regarding our new direction. Well, I mean to say, we still had a few Whitlock machines to quit. Although Mr Tittley started complaining about the lack of forward orders for new Whitlock stock. All's fair in love and war, they say.

Harry Wilson had investigated Lough Equipment thoroughly, he told us later, and was impressed by our company's dynamism.

Lough sales rep. Ian Barrett, supervising the loading of a JCB. (PHOTO: IMJ)

A JCB 3 working in a river bed. (PHOTO: Courtesy JCB)

Lough Equipment service van on site at 1966 Engineer's Field Day. Pictured (l. to r.) is service manager Gib Gospal and Sales Rep. Bill Flett. (PHOTO: IMJ)

Bill O'Connor, Lough demonstrator, flaunting the power of JCB hydraulics at The Orange Field Day, 1966. (PHOTO: IMJ)

So not only was he acquiring a switched on Australian distributor, but was also eliminating Whitlock as a sales opponent. Although the latter did not actually eventuate as Ken Coles Pty Ltd, a backhoe hire organisation, picked up the Whitlock agency, which soldiered on for another few years.

The press report

Eric Lough instructed me to prepare a press release, which was circulated in October 1965. It read as follows:

Following 12 months market research and thorough investigation of excavator (backhoe) trends throughout Europe and America, the Directors of Lough Equipment Pty. Ltd. have announced that on October 15 1965 their company will relinquish the Australian Whitlock franchise and will commence the distribution of JCB equipment.

It is with great reluctance that Lough Equipment finds it necessary to abandon the Whitlock association in favour of JCB, as it is not possible to be associated with a product over the years, to foster its development and promote its sales, without creating an attachment towards it. Notwithstanding this, it has always been this company's policy to offer the very best equipment available to the Australian earthmoving industry, and in order to continue this earnest desire we have entered into mutually satisfactory arrangements with J.C. Bamford (Excavators) Ltd, the world's largest manufacturer of rubber tyred excavators.

A few weeks prior to the press release, Eric Tittley was advised of the state of affairs. Frankly, I felt sorry for him. He was actually a decent but naive gentleman of the old school. He was an accountant by training with no expertise in marketing. Seemingly the wrong man for the job, in this cut throat machinery business. Tragically, some time later he was found drowned in the surf at Surfers Paradise.

JCB days

There were no less than five backhoes in the JCB range, all of which were equipped with front loaders, apart from the JCB 1, which had a front mounted back filling blade. All were fitted with lock up cabins and all were marketed by Lough Equipment in Australia.

The JCB 1 was an unorthodox lightweight machine, powered by a Petter 20 h.p. diesel.

The JCB 2B was aimed at the Massey Ferguson 220 market and was mounted on a modified 44 hp Nuffield tractor. It had the amazing feature of being able to have the backhoe disconnected in two minutes! During a demonstration to the Sydney Metropolitan Water and Sewerage Board, one of the senior engineers failed to pay attention, and when he refocussed on what was going on, he was shocked to find the backhoe had 'broken off' from the tractor. The laugh was on him!

The JCB 3 was bigger capacity than the 2B but mounted on the same tractor, without the advantage of being able to be disconnected. It seemed to me to be a misfit in the JCB range. Others agreed and only a few were sold.

The JCB 3C was the jewel in the JCB stable. Mounted on an industrialised 60 h.p. Nuffield, it was a brilliantly capable and purposeful looking unit. Within two years of its launch in 1963 over 3000 had been sold.

The JCB 4C was a massive machine that could certainly pull out the dirt, but it was unwieldy and even dangerous to drive on the road. It was also too big to fit on a tip truck – a major

The powerful but ungainly 4C at work. (PHOTO: Courtesy JCB)

disadvantage. The 60 hp Nuffield was hard pressed to support the bulk of the unit.

In 1965 JCB introduced its stylish and capable 360 degree slew, track type hydraulic excavator – the JCB 7, powered by a Ford 96 hp diesel engine. Upon its arrival in Australia, it was claimed to be the most technically advanced excavator of its type. It represented a new experience for us at Loughs. For example, getting one in and out of the workshop, which was below ground level, proved a real challenge.

The first JCB 7 sold, was purchased by Tipping Bros. of Chatswood. Carlotta Street was blocked for over an hour as we struggled to load it onto a side load low loader, much to the irritation of scores of vehicles that were obliged to back out onto The Pacific Highway. Eventually it got underway but its height resulted in around 20 power wires being torn from their poles, all the way along Carlotta street. The low loader driver was blissfully unaware of the mayhem he was creating and the tangle of wires that trailed behind his rig.

And finally...

The Lough association with JCB was a happy one. Joe Bamford sent his 21 year old son Anthony to Sydney for an acquaintance with the Australian earthmoving scene.

As was our custom with all visiting industry dignitaries, Margery and I invited him to our home for dinner. He was accompanied by an old school friend, who was working his way round Australia and was currently employed as washer-up in a Kings Cross restaurant. Imagine our surprise when we learnt he was The Right Honourable Jeremy Sykes, the youngest son of a prominent English peer!

Anthony proved to be a likeable young man with a keen sense of humour. Margery originally came from Staffordshire, therefore she and Anthony got on famously and waxed on about villages and watering holes familiar to them both which, at that time, meant nothing to me.

Today, Sir Anthony Bamford is a multi billionaire and Chairman of JCB since 1976, following the retirement of his father Joseph Cyril, who died in 2001. Quite remarkably JCB remains a family owned business, with 18 factories spread throughout the UK, Brazil, Germany, North and South America, China and India. A range of 250 products are produced by a work force of around 7000 and sold into 150 countries.

JCB regularly sponsors numerous charitable and research activities, plus vintage car race events, around the world. In 2010 The JCB Academy, a new secondary school located in Rocester, UK, welcomed its first pupils.

In 2006 the JCB Dieselmax, propelled by twin JCB diesel engines, broke the diesel engine world land speed record by achieving a staggering 529 kmh.

In conclusion, although my involvement was but a miniscule cog in the history of JCB, I remember fondly my brief association with possibly the most enterprising and successful construction equipment manufacturer the world has ever known. Yes, these were good days. ■

The JCB 7C being loaded with considerable difficulty onto Tipping Bros. side loading float. Eric Lough can be seen on the left, supervising the procedure. See text. (PHOTO: IMJ)

The state of the art JCB factory near Uttoxeter, Staffordshire. The main frontage is a third of a mile long. It is but one of 18 JCB factories scattered around the world. (PHOTO: Courtesy JCB)

IAN'S MYSTERY TRACTOR QUIZ

QUESTION: Can you identify this grand tractor?

CLUE: It certainly is not American – or British – or Italian!

DEGREE OF DIFFICULTY: What is the weather going to do? It is that hard!

ANSWER: See page 48.

NORTHERN FOCUS
COVERING NORTHERN NSW AND QUEENSLAND

THE RESEARCH VIEW

Managing heavy stubble loads this season

■ By Jon Midwood, Chief Executive Officer, Southern Farming Systems

Stubble management has re-emerged as a serious consideration for grain growers throughout Australia's cropping regions. The issues associated with managing heavy stubble loads from the 2010–11 harvest is front of mind for growers. Southern Farming Systems CEO Jon Midwood has in recent weeks been addressing this subject at Grains Research and Development Corporation (GRDC) Adviser Updates in New South Wales, Victoria and South Australia.

AFTER water levels have subsided, paddocks dried out and the harvest finally finished, grain growers are now faced with the question: How to manage the large stubble from the 2010 harvest to minimise the impact on sowing in 2011?

Over the past decade stubble management practices in Australia have centered upon suitability to climate and environment – particularly in relation to soil erosion and growers' willingness to find alternatives to burning.

In the light and sandy soils of Western Australia's grain belt growers typically retain stubble to reduce soil erosion by wind and rain and to maximise plant available water (PAW) by holding moisture in the soil for longer over the typically dry summer months.

The close of the 2010 cropping season in south western Victoria has left growers with an unprecedented dilemma. Stubble burning has lost favour as a management technique due to the nutrients lost – namely nitrogen, phosphorus and potassium – subsequent soil erosion issues and problems with ash from the burn.

While this has caused a gradual shift away from stubble burning and the conundrum of what to do next, it is the exceptionally high stubble loads from the 2010 harvest, which are causing the largest concern.

During the drier seasons of the last seven to eight years, southern Australia's cereal stubble loads have typically been below three to four tonnes per hectare and the use of the wider row spacing at planting, which allows better residue flow and clearance, has generally worked extremely well.

This technique has also allowed the use of herbicides to be applied and incorporated by sowing and the reduction in yield, from wider row spacing, has not been a significant issue due to the weather creating a limit to seasonal yield potential.

Consultants' Corner

Consultants' Corner is an initiative by *Australian Grain* highlighting current GRDC-funded research with a particular focus on the commercial implications of adopting cutting-edge research.

Stubble management to minimise blockages at seeding starts at harvest by matching cutting height to seeder type and row spacing and by spreading as evenly as possible.
(PHOTO: Emma Leonard)

But the much wetter 2010 season has created far larger stubble loads and higher yields than most growers would have experienced for many years and most retained stubble systems have not been tested under these conditions.

In a wetter season growers are essentially left with four basic courses of action:

- Burn stubble;
- Retain the stubble;
- Graze heavily and hope that sowing equipment will cope at seeding; or,
- Incorporate the stubble into the soil as mulch.

The latter option has been used with great success in the United Kingdom and Europe where their stubble loads are greater than the threshold of 3-4 tonnes per hectare and where changes to practice were driven by legislation in 1993 which banned stubble burning in the UK.

Typically, UK growers will chop all the straw on the header and spread this and the chaff as evenly as possible across the cutterbar width. This residue is then incorporated into soil to approximately 10–15 centimetres deep as soon as the header leaves the paddock.

This is achieved by cultivation equipment specifically designed for this job, usually consisting of high speed discs with suitable depth control, possibly with the addition of tines, and a packer roller to consolidate the work to maximise stubble to soil contact and minimise moisture loss.

While these techniques can be transferred directly to Australia and will work in our environment, Australia currently lacks the machinery options and knowledge of its use and technique for its adoption.

The success of this technique in Europe is linked to adequate rainfall and temperature which are important components in speeding up straw breakdown.

Longer time for the stubble to breakdown

Assuming there is adequate moisture in the soil – which there is in most parts of the southern and northern region of Australia this season – then one big advantage we have over European growers is the time for breakdown is significantly longer if stubble is incorporated immediately after harvest.

This can be as much as four months in Australia compared to four to five weeks in Europe. Research shows that in Queensland stubble break-down occurs almost twice as fast as that in Victoria because Queensland regularly receives adequate summer rainfall.

AT A GLANCE

- There is no single solution to managing heavy stubbles.
- Benefits from retaining stubble can take time to evolve.
- Stubble retention requires a systems approach taking into account seeding technique, herbicide application and crop type.
- Management starts at harvest with even spreading of residue and appropriate cutting height.
- Stubble retention can increase disease, pest and weed pressure and rigorous monitoring is essential.
- Farming system and machinery set-up influence crop establishment in heavy stubbles.
- Sowing inter-row can be the best method to manage stubble at seeding.
- Plan ahead to manage future scenarios where stubble burning could be banned through legislation.

Tips on converting to full stubble retention

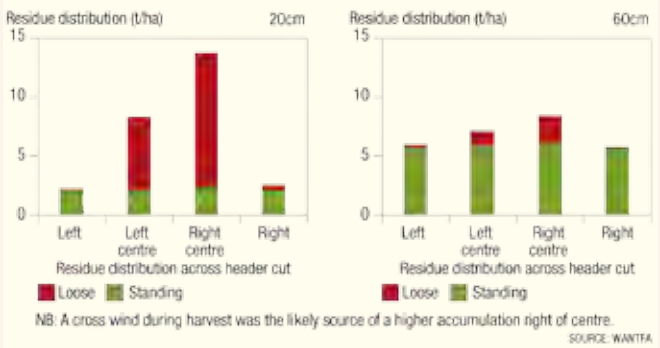
- Start on stubbles with less biomass – canola, pulses or low yielding cereals;
- Manage the timing of nitrogen application or strategic grazing of winter wheats to reduce the amount of unnecessary biomass;
- Modify existing equipment; and,
- Plan seeding at harvest – match residue management treatment to the capacity of seeding equipment and crop row spacing.

HARVESTING HEIGHT AND STUBBLE SPREAD

Some recent research by the WA No-Tillage Farmers Association (WANTFA) has found significant improvement in straw spread with harvesters fitted with stubble spinners and when residue was cut high. This was due to the reduced amount of material to be distributed. This spreading capability is especially important with large capacity machines with wide fronts which can concentrate residue and chaff by a factor of seven to 11 times.

The WANTFA work showed that when large volumes of stubble are spread, the chaff and straw interacts, increasing the overall bulk of material affected by air-drag. This results in a reduced spread distance. It was found that in both short and tall stubble, harvesters could not spread the full width of the harvester front but when cutting height was maximised straw spreading was more uniform.

FIGURE 1: Distribution of crop residue when harvesting at 20 cm and 60 cm cutting heights



NB: A cross wind during harvest was the likely source of a higher accumulation right of centre.
SOURCE: WANTFA

Stubble burning does have its place and is particularly useful when planting a crop like canola. Canola is a difficult crop to get established and has an extremely small seed requiring good soil to seed contact.

When stubble is burnt and residue removed, the grower is able to limit potential for slug populations. In this scenario, a late stubble burn can be a good management decision.

But the current method of burning stubbles as a management tool in Australia is problematic.

It is a bad idea on very light soils, or soils prone to erosion. When stubbles are burnt, not only are nutrients lost from the straw – including nitrogen, phosphorus and potassium – but also sulphur and carbon.

Widespread burning also works against the longer-term sustainability of a grain-growing operation and the opportunity to enhance soil carbon levels by returning the straw to the soil.

Selecting the correct stubble management technique is extremely important to growers and must be determined before harvest. At this stage decisions can be made on stubble height and what the next operation will be in the paddock whether burning, incorporation, baling or stubble retention.

One thing is for certain, a large amount of unavoidable structural damage will have occurred to our soils during the harvesting operation. But if we ignore this and hope that by using full stubble retention these soils will restructure themselves, many growers will be very disappointed.

For more information see: www.grdc.com.au/GRDC-FS-StubbleManagement ■

CONSULTANTS' CORNER – THE COMMERCIAL VIEW

PRECISION APPROACH TO STUBBLE MANAGEMENT

■ **By Andrew Whitlock, PrecisionAgriculture, Ballarat, Victoria**

Stubble management has been a key issue throughout harvest and leading into the new season's planting.

PrecisionAgriculture's main clients are growers who operate no-till, controlled traffic farming systems. We are currently working with our growers to determine their best course of action for dealing with high stubble loads.

Our clients tend to retain stubble for both environmental and economic benefits – mainly water and wind erosion, improved water infiltration and for the protection given to emerging crops.

Andrew Whitlock says that adopting a full stubble retention system will have wide-ranging agronomic impacts – this in turn requires significant management changes by growers.

We find the competition for sunlight between the stubble and new crop forces the crop to grow upwards to obtain its share. This is particularly beneficial to legume crops and makes for an easier run at harvest.

In these systems, where possible, stubble is retained standing and the following crop is inter-row sown at row spacings ranging from 25–38 centimetres.

What are the benefits of retained stubble?

Ascertaining the environmental benefit of a retained stubble to the cropping system is difficult. Research has shown any benefit to soil carbon levels occurs at a very slow rate and it would be many years before any difference is noted. Farmers, however, are reporting softer soils, an increase in earth worms and a resilience to dry seasons.

Stubble management begins at harvest and growers need to consider plans for the next season before the header begins its work. Stubble height will be determined by the next season's crop. We are seeing most growers cut crops in one pass, adjusting their header height in line with the following crops' requirements.

The inter-row sowing system has worked well during the past decade in south west Victoria, but wetter summers and heavier stubble loads during the past two seasons have presented the need to implement a flexible approach to stubble management.

Soil moisture during summer has been relatively high during the past two seasons and in turn we are experiencing increased soil biological activity. An increase in biological activity means stubble residue is being eaten away at the point of soil contact and weakened.

Stubbles are then being knocked over by the planter when it moves through the paddock. Fallen stubble levels build up and can cause blockages in the planting process. These summer rains also promote weeds which can also cause blockage headaches at sowing – effective summer weed control is critical for enhancing sowing conditions and storing soil moisture.

There are a broad range of stubble management techniques which will certainly vary from farm-to-farm. These include burning, baling, heavy grazing, slashing, incorporation/mulching and inter-row sowing.

We are seeing improved stubble handling with row spacings ranging from 30 to 38 cm and with 2 cm accurate machine guidance (autosteer) at sowing.

Growers can also consider applying fluted disc coulters to their planter to cut through residue or weeds in the path of a tine seeder.

Earlier planting opportunity

In the previous run of dry seasons, no-till/standing stubble has generally given farmers the confidence to sow a little bit earlier and this has in turn resulted in better results from a water use efficiency point of view.

Nevertheless, farmers are also aware that in the event of a wet summer and autumn we might find stubble retention could present problems with soil being too wet at the surface.

This is especially so in south west Victoria where we have the combination of heavy stubble loads and heavily textured soils. We currently have a very full soil moisture profile and if we receive even average rainfall up until planting, we will have fairly damp sowing conditions.

It is also critical to understand the agronomic implications of implementing a stubble retention system. There are implications for soil nutrient levels, disease and pests (a likely increase), crop rotations, timing of sowing and herbicide applications – and they all require careful management.

Stubble management is a key issue for growers and is one of the main topics we are speaking to our clients about – particularly around harvest time. This is when stubble management begins.

Contact Andrew on 0458 312 589, E: andrew@precisionagriculture.com.au

Frost risk and sowing date – resisting the temptation

By Jack Christopher[1], Troy Frederiks[2] and Andrew Borrell[1]

IT is well known that the theoretical maximum yield potential for winter cereals in Australia is achieved when crops flower mid winter (July–August). But for most parts of the northern grains region, there is a very high probability that crops flowering in July and August will be lost to frost damage.

Yield potential drops rapidly after the optimum date at between one to two per cent per day (Figure 1).

As we generally recommend planting dates leading to an early September flowering date, the delay past the optimum is at least five weeks and often up to seven or eight weeks.

In the northern grains region conflicting climatic influences – including moisture availability and high temperatures – severely constrain the timing of winter cereal flowering and grain filling if yield potential is to be maximised in face of frost risk (Figure 2).

A balancing act

We are faced with a very delicate balancing act. If we plant too early there is a high risk of complete crop loss due to frost but as sowing is delayed, yield potential declines rapidly.

Careful matching of variety to planting opportunity is essential.

In the absence of frost resistant winter cereals genotypes, our main strategy to minimise crop losses while maximising yield potential is to aim to achieve crop flowering and grain filling in the short window of opportunity following the main frost risk period (Figure 2)

To give growers the best possible planting information for new varieties before they are released it is essential to have accurate data on flowering date (phenology).

Breeder's trials do not provide sufficiently detailed information. They are often assessed only once during the season for flowering date and they usually provide information for only one planting date at each site.

We cannot predict flowering date for genotypes based on pedigree nor can we predict flowering date for one district based on trial data from other regions.

For this reason the flowering date for genotypes destined for the northern grains region has been tested in detailed phenology trials at a range of sites with four dates of sowing by DEEDI physiologists since 1976. Phenology data is reported to breeders

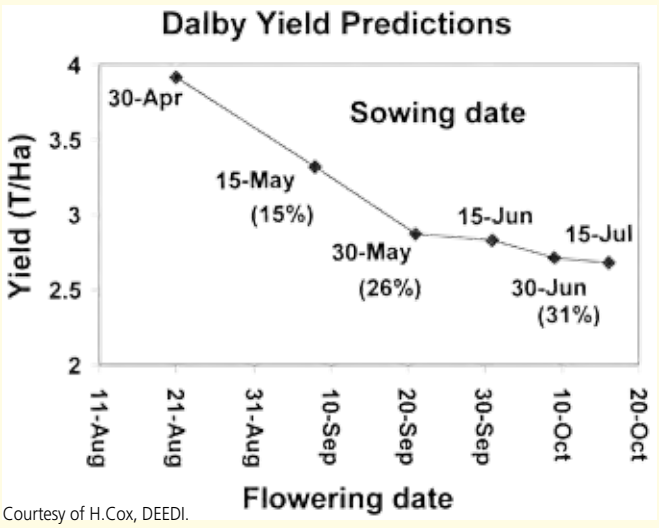
AT A GLANCE

- Delayed planting is essential to avoid crop loss due to frost but severely limits yield potential.
- Variety guides and decision support software are invaluable tools for matching of cultivar to planting opportunity to maximise yield with acceptable frost risk.
- Remote sensing technologies offer significant potential to improve recommendations to growers.

For now, growers should do the following:

- Be sure of the cultivar and sow within the correct window for their district;
- Use a number of cultivars and planting dates to spread risk;
- Consider early sown cultivars with a longer growing season when more favourable seasons are predicted and later sown, shorter season cultivars when less in-season rainfall is forecast.

FIGURE 1: Mean predicted yields for different sowing dates generated by *Whopper Cropper* using 100 years of historical meteorological data for Dalby



Courtesy of H.Cox, DEEDI.

FIGURE 2: Some climatic factors influencing winter cereals yield potential in the northern grains region

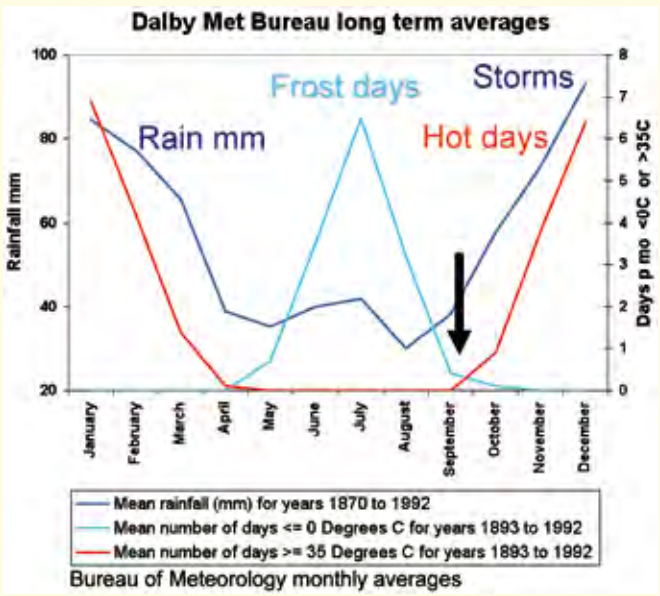
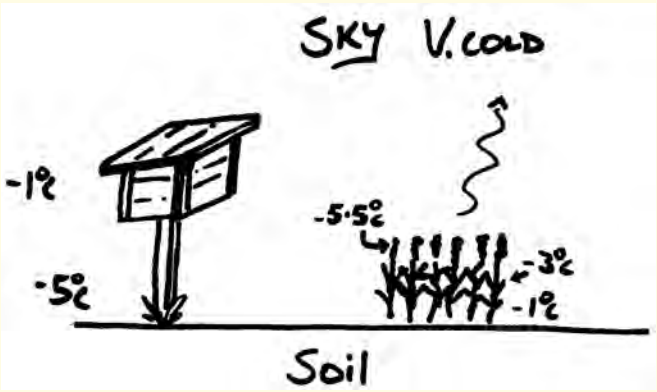


FIGURE 3: Illustration of how spatial temperatures can vary during a radiative frost on a clear, still night



and used by DEEDI industry liaison officers to provide planting recommendations for growers.

Planting in the correct window does not guarantee that crop loss due to frost will be averted – nor does it always prevent drastic yield reduction due to late season heat and drought stress.

But planting a variety too early can lead to a very high probability of crop loss.

Seasonal temperature variation changes the days to flowering for each cultivar from season to season.

Can remote sensing help recommendations?

Variety and sowing date recommendations are based on one or a few sites for each district and may not correlate exactly with expectations in a particular grower's paddocks. So in many instances, the recommendations likely err on the side of caution.

Stevenson screen temperatures measured at Bureau of Meteorology stations do not accurately indicate frost risk.

Measurements taken using exposed thermometers at canopy height give a much more accurate indication of the likelihood of crop damage (Figure 3).

Night time satellite images of winter crops taken in the infrared spectrum can give an estimate of the temperature of the actual crop canopy over whole districts at once.

It is quite possible that detailed calibration of infrared satellite image data with historical data on frost damage collected at DEEDI frost trials, could be used to generate detailed historical data sets for large parts of the northern cropping region at the paddock scale.

If this were achieved, it may be possible to develop paddock-specific planting recommendations that are closer to the optimum trade-off of yield potential versus frost risk.

Data on crop temperatures at canopy height for individual grower's paddocks can be used to develop specific recommendations for each paddock in the *Wheatman* computer software package.

Interaction between frost risk and soil moisture

There is little specific data or even modelling predictions on the yield effects of interactions between soil moisture and frost avoidance strategies for winter cereal cropping in the northern region. But some useful observations can be made.

Initial soil moisture can be one of the most significant 'known' factors growers can use to optimise cropping strategies for any given season. This means, initial soil moisture should be measured as often as possible.

In seasons with adequate in-season rainfall, early sown cultivars with a longer growing season are likely to 'catch' more rainfall events and so accumulate greater biomass and higher yield potential than shorter season varieties.

But in seasons with less starting moisture and/or less in-season rainfall, early sown varieties may exhaust the available soil moisture before grain filling is completed. This will lead to reduced yield and potential downgrading due to screenings.

A check on rainfall and soil moisture records shows that terminal drought stress is experienced in most districts of the northern grains region in the majority of seasons.

We would also anticipate a correlation between in-season rainfall and frequency – as well as severity – of frost events. Frosts are likely to be more frequent and severe in drier seasons.

When choosing the most suitable cultivars for the coming season, growers need to carefully consider initial soil moisture conditions and forecasts of likely in-season rainfall.

In general, favour early planted longer season varieties when good in-season rainfall is being predicted but later sown cultivars when not.

But decreasing rainfall as the sowing season progresses means that planting opportunities may be missed.

We are currently studying varieties that are able to extract more soil moisture from deep in the profile late in the season.

Varieties with this capability will improve yield potential by accessing more soil moisture giving better yield and grain quality results than standard cultivars in years of terminal drought.

Contact: Dr Jack Christopher, Ph: (07) 4639 8813; E: j.christopher@uq.edu.au

1. Qld Alliance for Agricultural and Food innovation (QAAFI; UQ & DEEDI).
2. AgriScience Queensland, QLD Government, DEEDI. ■

In the foreground is an April sown frost trial showing severe damage from July frosts versus a recently planted grower's crop in the background. Photo date was August 3, 2008 near Kingsthorpe on the eastern Darling Downs.

Chickpeas: What happened last year and what to do in 2011

By Kevin Moore[1], Malcolm Ryley[2], Ted Knights[1], Paul Nash[1], Gail Chiplin[1] and Gordon Cumming[3]

What happened in 2010?

The 2010 winter season was exceptionally wet, with rainfall totals and the number of rainy days far exceeding long term averages. For example, at Goondiwindi 416 mm of rain fell on 57 days (44 days >1.0 mm) between June 1 and November 30, compared with a long-term average of 263 mm on 34 days (26 days >1.0 mm).

This pattern encouraged rapid vegetative growth of crops and was ideal for the build-up and spread of the major chickpea pathogens. Ascochyta blight (AB, caused by *Ascochyta rabiei*), Botrytis grey mould (BGM, caused by *Botrytis cinerea*), Phytophthora root rot (PRR, caused by *Phytophthora medicaginis*) and Sclerotinia rot (caused by *Sclerotinia sclerotiorum* and *Sclerotinia minor*) were widespread and severe in many crops.

Water logging was common and compromised the plant's natural defences against pathogens.

The diseases (Table 1)

- **Ascochyta blight –** the pathogen survives and spreads in infected seed, stubble and on volunteers; chickpea is the only known host in Australia. Fruiting bodies (pycnidia) of *A. rabiei* develop on infected plant tissue, and spores which ooze from wet pycnidia are spread short distances and cause new infections. Under ideal conditions, AB can cycle as fast as five to seven days.
- **Botrytis grey mould –** like Ascochyta, the BGM pathogen can survive and spread in infected seed and stubble, and some strains produce dark hard sclerotes which also aid survival and spread. But unlike Ascochyta the BGM pathogen has a very wide host range, and is also able to colonise dead and dying tissue of virtually any plant. Huge numbers of spores are produced on BGM lesions and are spread on air currents. BGM can also cycle in five to seven days.
- **Phytophthora root rot –** *P. medicaginis* survives as thick-walled oospores which develop in infected roots of chickpea and other plants including lucerne and annual medics. When the soil is saturated with moisture, the oospores germinate to produce sporangia which release zoospores which swim to and infect chickpea roots. The pathogen is spread by movement of infected soil and water.
- **Sclerotinia rot –** both Sclerotinia species survive as hard black sclerotes in soil or mixed with seed. Both species have a very wide host range, including many weeds and most broadleaf crops. Infection of chickpea plants occurs directly at the crowns (both species) or from airborne spores produced in fruiting bodies on germinated sclerotes (*S. sclerotiorum*).

AT A GLANCE

- Unless you fully understand and appreciate the risk of chickpea diseases, do not plant chickpeas in 2011. The threat from seed-borne, foliar and root diseases is higher than it has ever been.
- Mild temperatures, long cloudy periods and frequent rainfall events across the Northern region were ideal for epidemics of four major diseases in 2010 chickpea crops.
- Management of Ascochyta blight and Botrytis grey mould was hindered by early canopy closure, shortage of fungicides, and challenges getting ground rigs into wet paddocks.
- High levels of disease in most crops resulted in large quantities of inoculum of all four pathogens building up across the entire region. 2011 chickpea crops are therefore at a higher-than-normal risk of infection from these pathogens.
- Careful selection of seed source, paddocks and varieties, combined with seed dressing and foliar fungicides, will help you manage these diseases in 2011.
- 2010 Tamworth Ascochyta trials confirmed PBA HatTrick's Ascochyta rating and demonstrated that new lines have even better resistance to that disease.

TABLE 1: Key facts about the biology of major chickpea diseases

Disease	Survival	Spread	Infection by
Ascochyta	Stubble, seed, volunteers	Stubble, seed, water-splashed spores	Water-splashed spores
Botrytis	Stubble, seed, sclerotes alternative hosts	Stubble, seed, soil, airborne spores	Airborne spores
Phytophthora	Oospores, alternative hosts	Soil and surface water	Waterborne spores
Sclerotinia	Sclerotes in soil and seed, alternative hosts	Soil and water, airborne spores	Airborne spores or directly into crowns

Factors that contributed to the 2010 epidemics

- **Short rotations –** the recent trend of CP-W-CP-W rotations carries a high risk of diseases in both components of the rotation. This tightening of rotations reached an extreme in 2010 when PBA HatTrick was sown (1st week May) in a paddock that had grown Jimbour in 2009. Not surprisingly, Ascochyta was common in the PBA HatTrick when inspected on August 17, 2010.
- **Early planting (April – mid May) and narrow rows –** this combination encouraged early canopy closure, resulting in high in-crop humidity and poor penetration of fungicides (Ascochyta blight, BGM, Sclerotinia rot).
- **Missing the first and/or second Ascochyta sprays –** the early season sprays are an important part of an integrated Ascochyta management plan. This becomes critical in a season such as 2010, when missing the first and/or second spray allows the fungus to get a hold on the crop, making subsequent management challenging or impossible.

- **Frequent overcast, showery weather –** was ideal for multiple infection cycles, resulting in the rapid development of all four diseases.
- **Lack of supply of effective fungicides –** the large area of chickpeas planted in the northern region, combined with frequent rain early in the season, resulted in a widespread Ascochyta epidemic. This led to a severe shortage of registered fungicides in September when BGM started to develop.

Consequences for the 2011 season

- **Low supplies of disease-free seed –** because most chickpea crops in the northern region were affected by BGM and many by Ascochyta, the supply of disease-free seed from 2010 crops will be limited.
- **High levels of infected residues –** chickpea residue (particularly stems and pods) infected with Ascochyta and Botrytis will be a major source of infection for the 2011 crop.
- **High levels of soil borne inoculum –** there will be large numbers of Botrytis and Sclerotinia sclerotes and Phytophthora oospores in paddocks where the diseases were a problem or where soil and water have moved.

Integrated disease management

A range of practices need to be used to manage chickpea diseases in 2011. The build up of pathogens means that most 2011 chickpea crops in the northern region will be at a greater risk from disease than in previous years. The following will help minimise their impact:

Pre-plant practices

- **Stubble management –** the Ascochyta and Botrytis pathogens are likely to remain viable for as long as infected stubble remains on the soil surface. Burying stubble removes the ability of these pathogens to release spores and increases the rate of stubble breakdown. Although burning chickpea stubble will significantly reduce the amount of infected residues, it will not guarantee freedom from Ascochyta or Botrytis when chickpeas are next grown in that paddock. Stubble management is unlikely to have any major beneficial effect on Sclerotinia or Phytophthora.
- **Control volunteers and weeds (the green bridge) –** weeds and alternative hosts need to be controlled (BGM, Sclerotinia, Phytophthora), and volunteer chickpea plants which can harbour all four pathogens should be removed.
- **Paddock selection –** The standard recommendations of maintaining a distance of at least 500 metres from 2010 chickpea paddocks and a break of at least three years between chickpeas in the same paddock may not be effective as disease management tools in 2011. These tools work by reducing the amount of inoculum available to initiate infection early in the season. This has been compromised by surface water flow and floods which can move soil, roots, nematodes, chickpea stubble and pathogen survival structures great distances.

  Nevertheless, there are some basic rules that still apply, that is never plant a crop back into its own residue or that of a related species and do not attempt to keep a paddock of volunteer chickpeas as summer crop. The plants will be severely infected by pathogens (and Heliothis) and will provide early season inoculum for you and your neighbours' 2011 chickpeas.

  Apart from the risks of Phytophthora and water logging, avoid growing chickpeas in poorly drained paddocks. Observations in 2010 indicate that the natural resistance all plants have to pathogens and pests is compromised when plants are stressed (from saturated conditions).

  In one 2010 Tamworth trial, Flipper had more Ascochyta than an adjoining plot of Yorker – this is not what we would expect. In another Tamworth trial there was more Ascochyta in the wettest Kyabra plot compared with better drained plots of Kyabra, in spite of the fact that all had been sprayed eight times with 1.0 L/ha chlorothalonil. In other words, stress from water logging reduced our ability to manage Ascochyta with a strategy that worked in less stressed plots.
- **Community diseases –** Some diseases, like chickpea Ascochyta, are community diseases in that what happens in the paddock next door or even several kilometres away can impact on your crop. As such, these diseases should be managed at the community level.

  For example: you are following the Ascochyta management recommendations and have delayed or suppressed early season disease. But someone nearby (especially upwind or upslope) has not followed the recommendations and has allowed Ascochyta to get a hold of their crop early in the season. This puts your crop under extra disease pressure and in a season that favours Ascochyta may render difficult or impossible its management on susceptible varieties.

  And it's not just susceptible varieties. The 2010 season showed that growing varieties with improved Ascochyta resistance close to susceptible varieties, made disease management in those "resistant" varieties challenging. Communities that work together will have a far better chance of successfully managing diseases like Ascochyta.

Select the best variety

Chickpea varieties in the GRDC Northern Region are susceptible to both Sclerotinia species, and all are susceptible to BGM (Howzat is rated MS). But there are varying levels of resistances to Ascochyta and Phytophthora (Table 2). Consider planting a variety with the highest levels of resistance to either or both pathogens.

Use good quality seed

- **Seed source –** quality planting seed from the 2010 harvest is likely to be in short supply. Do not plant seed with low germination and/or poor vigour or with Ascochyta and/or Botrytis infection greater than 20 per cent. Whilst increasing sowing rate of low quality seed may seem reasonable, it carries a high risk of poor establishment. If the low quality is caused by seed borne pathogens, the seed will be a source

Ascochyta blight on chickpea pods.

For a successful chickpea crop this year, you must be fully aware of the severe disease risk and be prepared to adopt the full range of control and management strategies.

of infection for healthy seed and seedlings. Obtain seed from a commercial supplier or from a source known to have low levels of seed borne pathogens.

Use seed from 2009 crops if its germination and vigour are acceptable. Irrespective of year of harvest and source, all planting seed should be treated with a registered thiram-based seed dressing. After treatment, have the seed tested for germination and vigour.

- **Seed dressings –** thiram-based fungicides are effective in significantly reducing, but not eliminating, damping off of seedlings from BGM-infected seed, and are extremely effective in reducing the risk from seed borne Ascochyta. Although metalaxyl-based fungicides are registered for the control of *P. medicaginis* on chickpea seedlings, they are expensive and short-lived.

Sowing time

Early planting (and narrow rows) increases the risk of Ascochyta, BGM and Sclerotinia by providing ideal in-crop conditions for infection and development. For all diseases, consider planting later in the sowing window. Whilst this may lead to lower yields (in an average year), it will reduce the risk of early season Ascochyta and Phytophthora.

Later planting means less biomass in late winter/early spring which will lower the risk of BGM. It is not known if later planting will reduce the risk of Sclerotinia basal stem rot, but it will reduce the risk of *S. sclerotiorum* infecting aerial parts of the plant by air borne spores (ascospores). It will also mean more available soil moisture during pod fill should conditions in spring be dry.

TABLE 2: Resistance ratings[a] of some northern region varieties to *Ascochyta rabiei* and *Phytophthora medicaginis* and *Botrytis cinerea*

Variety	Ascochyta	Phytophthora	Botrytis
PBA HatTrick	MR/R	MR	S
Flipper	MR	MS	S
Yorker	MS/MR	MR	S
Howzat	S	MS	MS
Jimbour	S	MS/MR	S
Kyabra	S	MS	S
Genesis090	R	VS	VS
Genesis425	R	MS	S
Almaz	MS/MR	VS	S

[a]Resistance ratings are for low-moderate disease pressure situations. In a season such as 2010 when repeated cycles of infection occur, even MR varieties can have yield-reducing levels of disease

Row spacing

Consider wider rows (75 cm – 1 m) as these increase air movement through the crop and lower humidity in the canopy. This reduces the number and duration of infection events for Ascochyta, Botrytis and Sclerotinia. Wider rows are unlikely to have much impact on Phytophthora and nematodes but may reduce (i) inter-row spread and (ii) the consequences of such diseases as plants are less likely to be stressed from lack of water in spring.

In-crop fungicides

There are no in-crop fungicides registered on chickpea for Phytophthora or Sclerotinia. Several fungicides are registered or under-permit for BGM and Ascochyta. Regular monitoring and timely application of fungicides are crucial for good control. Of the two fungicides currently registered for Ascochyta, chlorothalonil is better than mancozeb under high disease pressure. Visit www.pulseaus.com.au for information on fungicides and rates.

Fungicide control of BGM

A preventative spray of a registered or under-permit fungicide before canopy closure, followed by another application two weeks later will help minimise BGM in most years. If BGM is detected in a district or in an individual crop, particularly during flowering or pod fill, a fungicide should be applied before the next rain event. None of the fungicides currently registered or under permit for chickpea BGM have eradicant activity, so their use will not stop established infections. Consequently, timely and thorough applications are critical.

Fungicide control of Ascochyta blight

The high inoculum levels generated in 2010 mean that (with the exception of Genesis lines with an R rating for Ascochyta), All varieties, irrespective of their resistance rating, should get a protective spray before the first post-emergent rainfall event, or three weeks after emergence, or at the three-leaf stage – whichever comes first.

All varieties should be sprayed again before the second post-emergent rainfall event, unless this occurs within two weeks of the first event.

After this, we advise the following:

- **Jimbour, Kyabra, Howzat, Yorker, Almaz, other susceptible varieties –** apply a third fungicide if two weeks have elapsed and rain is forecast; continue monitoring and spray again if Ascochyta is detected.
- **Flipper, PBA HatTrick, Genesis lines less than R rating –** monitor the crop and if Ascochyta is found, spray prior to the next rainfall event; further sprays may be needed

The pods of ALL varieties (including Genesis lines with an R rating) are more susceptible to Ascochyta than are the vegetative parts, so protective sprays will be needed if Ascochyta is present in the crop or neighbourhood.

Harvest and post-harvest

- If using contract harvesters, ensure that they are cleaned of soil and chickpea residue before entering your property.
- Harvest crops or areas of crops with the lowest levels of disease first.
- Avoid moving stubble and soil around your farm or to other properties

1. Industry and Investment NSW.
2. Department of Employment, Economic Development and Innovation, Qld.
3. Pulse Australia.

Contact Kevin Moore, Ph: (02) 6763 1133, Mob: 0488 251 866, Email: Kevin.Moore@industry.nsw.gov.au

SOUTHERN AUSTRALIA FOCUS

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THE RESEARCH VIEW

Managing heavy stubble loads

By Jon Midwood, Chief Executive Officer, Southern Farming Systems

Stubble management has re-emerged as a serious consideration for grain growers throughout Australia's cropping regions. The issues associated with managing heavy stubble loads from the 2010–11 harvest is front of mind for growers. Southern Farming Systems CEO Jon Midwood has in recent weeks been addressing this subject at Grains Research and Development Corporation (GRDC) Adviser Updates in New South Wales, Victoria and South Australia.

AFTER water levels have subsided, paddocks dried out and the harvest finally finished, grain growers are now faced with the question: How to manage the large stubble from the 2010 harvest to minimise the impact on sowing in 2011?

Over the past decade stubble management practices in Australia have centered upon suitability to climate and environment – particularly in relation to soil erosion and growers' willingness to find alternatives to burning.

In the light and sandy soils of Western Australia's grain belt growers typically retain stubble to reduce soil erosion by wind and rain and to maximise plant available water (PAW) by holding moisture in the soil for longer over the typically dry summer months.

The close of the 2010 cropping season in south western Victoria has left growers with an unprecedented dilemma. Stubble burning has lost favour as a management technique due to the nutrients lost – namely nitrogen, phosphorus and potassium – subsequent soil erosion issues and problems with ash from the burn.

While this has caused a gradual shift away from stubble burning and the conundrum of what to do next, it is the exceptionally high stubble loads from the 2010 harvest, which are causing the largest concern.

During the drier seasons of the last seven to eight years, southern Australia's cereal stubble loads have typically been below three to four tonnes per hectare and the use of the wider row spacing at planting, which allows better residue flow and clearance, has generally worked extremely well.

This technique has also allowed the use of herbicides to be applied and incorporated by sowing and the reduction in yield, from wider row spacing, has not been a significant issue due to

Consultants' Corner

Consultants' Corner is an initiative by *Australian Grain* highlighting current GRDC-funded research with a particular focus on the commercial implications of adopting cutting-edge research.

Stubble management to minimise blockages at seeding starts at harvest by matching cutting height to seeder type and row spacing and by spreading as evenly as possible.
(PHOTO: Emma Leonard)

the weather creating a limit to seasonal yield potential.

But the much wetter 2010 season has created far larger stubble loads and higher yields than most growers would have experienced for many years and most retained stubble systems have not been tested under these conditions.

In a wetter season growers are essentially left with four basic courses of action:

- Burn stubble;
- Retain the stubble;
- Graze heavily and hope that sowing equipment will cope at seeding; or,
- Incorporate the stubble into the soil as mulch.

The latter option has been used with great success in the United Kingdom and Europe where their stubble loads are greater than the threshold of 3-4 tonnes per hectare and where changes to practice were driven by legislation in 1993 which banned stubble burning in the UK.

Typically, UK growers will chop all the straw on the header and spread this and the chaff as evenly as possible across the cutterbar width. This residue is then incorporated into soil to approximately 10–15 centimetres deep as soon as the header leaves the paddock.

This is achieved by cultivation equipment specifically designed for this job, usually consisting of high speed discs with suitable depth control, possibly with the addition of tines, and a packer roller to consolidate the work to maximise stubble to soil contact and minimise moisture loss.

While these techniques can be transferred directly to Australia and will work in our environment, Australia currently lacks the machinery options and knowledge of its use and technique for its adoption.

The success of this technique in Europe is linked to adequate rainfall and temperature which are important components in speeding up straw breakdown.

Longer time for the stubble to breakdown

Assuming there is adequate moisture in the soil – which there is in most parts of the southern and northern region of Australia this season – then one big advantage we have over European growers is the time for breakdown is significantly longer if stubble is incorporated immediately after harvest.

This can be as much as four months in Australia compared to four to five weeks in Europe. Research shows that in Queensland stubble break-down occurs almost twice as fast as that in Victoria because Queensland regularly receives adequate summer rainfall.

AT A GLANCE

- There is no single solution to managing heavy stubbles.
- Benefits from retaining stubble can take time to evolve.
- Stubble retention requires a systems approach taking into account seeding technique, herbicide application and crop type.
- Management starts at harvest with even spreading of residue and appropriate cutting height.
- Stubble retention can increase disease, pest and weed pressure and rigorous monitoring is essential.
- Farming system and machinery set-up influence crop establishment in heavy stubbles.
- Sowing inter-row can be the best method to manage stubble at seeding.
- Plan ahead to manage future scenarios where stubble burning could be banned through legislation.

Tips on converting to full stubble retention

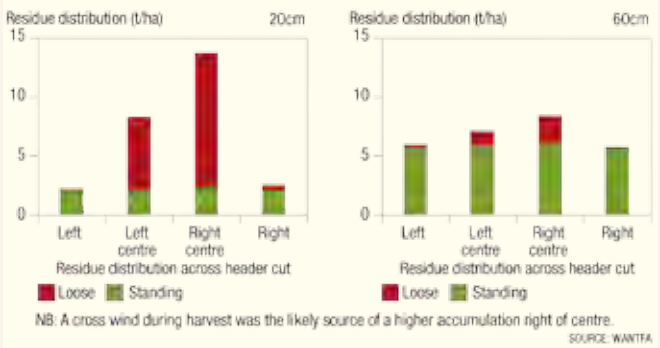
- Start on stubbles with less biomass – canola, pulses or low yielding cereals;
- Manage the timing of nitrogen application or strategic grazing of winter wheats to reduce the amount of unnecessary biomass;
- Modify existing equipment; and,
- Plan seeding at harvest – match residue management treatment to the capacity of seeding equipment and crop row spacing.

HARVESTING HEIGHT AND STUBBLE SPREAD

Some recent research by the WA No-Tillage Farmers Association (WANTFA) has found significant improvement in straw spread with harvesters fitted with stubble spinners and when residue was cut high. This was due to the reduced amount of material to be distributed. This spreading capability is especially important with large capacity machines with wide fronts which can concentrate residue and chaff by a factor of seven to 11 times.

The WANTFA work showed that when large volumes of stubble are spread, the chaff and straw interacts, increasing the overall bulk of material affected by air-drag. This results in a reduced spread distance. It was found that in both short and tall stubble, harvesters could not spread the full width of the harvester front but when cutting height was maximised straw spreading was more uniform.

FIGURE 1: Distribution of crop residue when harvesting at 20 cm and 60 cm cutting heights



NB: A cross wind during harvest was the likely source of a higher accumulation right of centre.

SOURCE: WANTFA

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Choose certainty over chance

Stubble burning does have its place and is particularly useful when planting a crop like canola. Canola is a difficult crop to get established and has an extremely small seed requiring good soil to seed contact.

When stubble is burnt and residue removed, the grower is able to limit potential for slug populations. In this scenario, a late stubble burn can be a good management decision.

But the current method of burning stubbles as a management tool in Australia is problematic.

It is a bad idea on very light soils, or soils prone to erosion. When stubbles are burnt, not only are nutrients lost from the straw – including nitrogen, phosphorus and potassium – but also sulphur and carbon.

Widespread burning also works against the longer-term sustainability of a grain-growing operation and the opportunity to enhance soil carbon levels by returning the straw to the soil.

Selecting the correct stubble management technique is extremely important to growers and must be determined before harvest. At this stage decisions can be made on stubble height and what the next operation will be in the paddock whether burning, incorporation, baling or stubble retention.

One thing is for certain, a large amount of unavoidable structural damage will have occurred to our soils during the harvesting operation. But if we ignore this and hope that by using full stubble retention these soils will restructure themselves, many growers will be very disappointed.

For more information see: www.grdc.com.au/GRDC-FS-StubbleManagement ■

CONSULTANTS' CORNER – THE COMMERCIAL VIEW

PRECISION APPROACH TO STUBBLE MANAGEMENT

■ **By Andrew Whitlock, PrecisionAgriculture, Ballarat, Victoria**

Stubble management has been a key issue throughout harvest and leading into the new season's planting.

PrecisionAgriculture's main clients are growers who operate no-till, controlled traffic farming systems. We are currently working with our growers to determine their best course of action for dealing with high stubble loads.

Our clients tend to retain stubble for both environmental and economic benefits – mainly water and wind erosion, improved water infiltration and for the protection given to emerging crops.

Andrew Whitlock says that adopting a full stubble retention system will have wide-ranging agronomic impacts – this in turn requires significant management changes by growers.

We find the competition for sunlight between the stubble and new crop forces the crop to grow upwards to obtain its share. This is particularly beneficial to legume crops and makes for an easier run at harvest.

In these systems, where possible, stubble is retained standing and the following crop is inter-row sown at row spacings ranging from 25–38 centimetres.

What are the benefits of retained stubble?

Ascertaining the environmental benefit of a retained stubble to the cropping system is difficult. Research has shown any benefit to soil carbon levels occurs at a very slow rate and it would be many years before any difference is noted. Farmers, however, are reporting softer soils, an increase in earth worms and a resilience to dry seasons.

Stubble management begins at harvest and growers need to consider plans for the next season before the header begins its work. Stubble height will be determined by the next season's crop. We are seeing most growers cut crops in one pass, adjusting their header height in line with the following crops' requirements.

The inter-row sowing system has worked well during the past decade in south west Victoria, but wetter summers and heavier stubble loads during the past two seasons have presented the need to implement a flexible approach to stubble management.

Soil moisture during summer has been relatively high during the past two seasons and in turn we are experiencing increased soil biological activity. An increase in biological activity means stubble residue is being eaten away at the point of soil contact and weakened.

Stubbles are then being knocked over by the planter when it moves through the paddock. Fallen stubble levels build up and can cause blockages in the planting process. These summer rains also promote weeds which can also cause blockage headaches at sowing – effective summer weed control is critical for enhancing sowing conditions and storing soil moisture.

There are a broad range of stubble management techniques which will certainly vary from farm-to-farm. These include burning, baling, heavy grazing, slashing, incorporation/mulching and inter-row sowing.

We are seeing improved stubble handling with row spacings ranging from 30 to 38 cm and with 2 cm accurate machine guidance (autosteer) at sowing.

Growers can also consider applying fluted disc coulters to their planter to cut through residue or weeds in the path of a tine seeder.

Earlier planting opportunity

In the previous run of dry seasons, no-till/standing stubble has generally given farmers the confidence to sow a little bit earlier and this has in turn resulted in better results from a water use efficiency point of view.

Nevertheless, farmers are also aware that in the event of a wet summer and autumn we might find stubble retention could present problems with soil being too wet at the surface.

This is especially so in south west Victoria where we have the combination of heavy stubble loads and heavily textured soils. We currently have a very full soil moisture profile and if we receive even average rainfall up until planting, we will have fairly damp sowing conditions.

It is also critical to understand the agronomic implications of implementing a stubble retention system. There are implications for soil nutrient levels, disease and pests (a likely increase), crop rotations, timing of sowing and herbicide applications – and they all require careful management.

Stubble management is a key issue for growers and is one of the main topics we are speaking to our clients about – particularly around harvest time. This is when stubble management begins.

Contact Andrew on 0458 312 589, E: andrew@precisionagriculture.com.au

Blackleg fungus genome secrets revealed

THE genome of the Blackleg fungus – which causes the most damaging disease to canola crops worldwide – has been sequenced for the first time by a team of French and Australian scientists. Professor Barbara Howlett from the School of Botany at the University of Melbourne, who led the Australian research team, said the discovery was a significant step towards controlling the rampant Blackleg disease.

"The 12,500 genes that constitute the genetic blueprint for the fungus *Leptosphaeria maculans* have been identified and now can be mined to discover how this fungus causes the deadly disease," Barbara said.

Blackleg disease can devastate crops and in 2003 caused 90 per cent yield losses in some regions of Australia. The fungus reproduces so prolifically that it develops into genetically diverse populations that can quickly overcome the efficacy of resistance genes in canola crops.

"We have known for a long time that this fungus can evolve to become virulent and cause disease very quickly. Now we are much better placed to tell farmers which canola varieties they should sow to maximise their yield," she said.

The study published in the prestigious on-line journal *Nature Communications* also involved researchers from the French National Institute for Agricultural Research (INRA), led by Dr Thierry Rouxel and the Australian Centre for Necrotrophic Fungal Pathogens in Perth, Western Australia, led by Professor Richard Oliver.

Predicting disease outbreaks

Using information from the genome sequence, researchers have developed molecular markers that can predict whether disease outbreaks will occur.

"If an epidemic is predicted then farmers can plant a different canola variety, which will not readily succumb to disease," Barbara said.

The study revealed a unique compartmentalisation of the genome into discrete alternating blocks that are either gene-rich or gene-poor. "Such a feature has not been seen previously in a fungal genome," Barbara said.

"These gene-poor regions have few active genes but those that are present play important roles in the disease."

She said other regions of the genome are gene-rich and contained the 'housekeeping' genes – the pedestrian but essential genes necessary for an organism to survive.

"What our study revealed is that it is the location of the disease-related genes within the junk DNA which allows the genes to be readily mutated, lost or gained. This enables the blackleg fungus to cause disease outbreaks on canola varieties with particular resistant genes."

"The development of markers using information from the genome sequence enable us to better target the disease making genes and provide us with better information for crop protection strategies," she said.

These findings feed into a national project led by Barbara and funded by the GRDC which is aimed at developing disease management strategies for canola farmers in a 'genome to paddock' approach. ■

An Australian first for lupin genome project

AS part of the first major plant genome sequencing project managed in Australia, CSIRO researchers will soon start sequencing the narrow leaf lupin genome.

Being conducted in collaboration with the Centre for Food and Genomic Medicine (CFGM) in Perth, WA, the three-year, $1.5 million project will enable researchers and breeders to accelerate lupin crop improvements such as drought tolerance, disease resistance and optimal flowering time.

The research team will build upon established resources and employ powerful next-generation sequencing technologies and innovative bioinformatics techniques in their efforts to sequence the genome.

Lupins, members of the legume family, are a valuable winter rotation crop that farmers can use to prevent diseases surviving from season to season in cereal crops such as wheat. They have the added benefit of fixing nitrogen in the soil.

Source of protein and dietary fibre

Lupins are also a good source of protein and dietary fibre and CSIRO scientists have already identified genes in lupins which produce proteins that impact on the nutritional content of the grain.

Studies conducted by the CFGM have shown these proteins

The leader of the lupin genome sequencing project, senior CSIRO Plant Industry scientist, Dr Karam Singh. (PHOTO: CSIRO)

have important wide ranging benefits for humans and may provide cardiovascular health benefits in terms of increasing insulin sensitivity and reducing blood pressure. The proteins could potentially reduce the risk of diabetes and obesity by increasing a person's sensitivity to insulin and creating the sensation of being 'full'.

Responsibility for overseeing the research project was awarded to the Western Australian Institute for Medical Research-based CFGM by the Grains Research and Development Corporation following a competitive national tender process.

The CFGM team will interact with national and international collaborators in China, Europe, Japan and the USA with sequencing and bioinformatic expertise to help gain and analyse the sequence data. The majority of the project will be conducted at the new CSIRO/University of Western Australia joint Crop Genomics laboratory at Floreat, in Perth and will be led by Prof Karam Singh (CSIRO/UWA).

The project's results will be published online for public access benefiting lupin researchers, lupin breeders and the broader community.

Science Contact: Prof. Karam Singh, Program leader, CSIRO Plant Industry
Ph: 08 9333 6320 E: Karam.Singh@csiro.au

Lupins provide a disease break in cereal based rotations and may have human health benefits too. (PHOTO: CSIRO)

Dry seeding yield benefits

CROP simulation modelling has revealed that dry seeding up to half of a 3000 hectare wheat program in a low rainfall area of Western Australia can deliver consistent yield benefits and significant increases in profits over time.

But researchers have warned that, despite the findings, growers need to be aware of the risks of dry seeding including crop failure, inadequate weed control and wind erosion.

The research was funded by the Department of Agriculture, Fisheries and Forestry (DAFF) and Grains Research and Development Corporation (GRDC) under the project 'Developing climate change resilient cropping and mixed cropping/grazing businesses in Australia'.

CSIRO researcher Michael Robertson presented the results at the 2011 Agribusiness Crop Updates, coordinated by the Grains Industry Association of Western Australia (GIWA) on behalf of the WA Department of Agriculture and Food (DAFWA) and the GRDC.

Michael said the research found that dry seeding up to 50 per cent of a 3000 hectare wheat program at Mullewa produced average farm wheat yields 0.1 to 0.3 tonnes per hectare better than those achieved from waiting to seed in wet conditions, in 80 per cent of seasons.

Yield results were achieved by applying the Agricultural Production Systems Simulator (APSIM) to actual rainfall data for Mullewa from 1971 to 2010.

"These results illustrate that earlier sowing dates through dry seeding of cereals generally results in higher yields, in the absence of frost," Michael said.

"When applied to actual farms, the results would vary according to factors including seeding capacity and soil erosion risk, but I am confident the principles of the results would remain the same."

Michael said the crop simulation modelling work had not yet been applied to other rainfall zones in WA, but he expected similar results.

"So far we have only looked at low rainfall situations because that is where growers are dry seeding a lot, but we plan to extend the research into the medium and high rainfall zones."

Michael said the research had been conducted to help quantify the yield effects of dry seeding cereals, which was increasing across southern Australia.

More growers were dry seeding cereals because opening rains were occurring later and with more variability.

"While it has long been common practice to dry sow lupins and canola before the seasonal break, dry seeding of cereals has only recently gained prominence in the wheatbelt," Michael said.

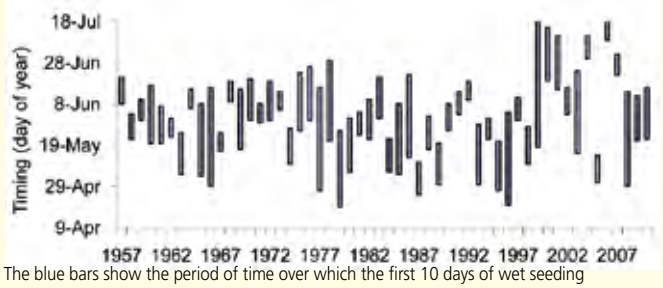
"Growers are not completely confident if they are doing the right thing."

Michael said growers considering dry seeding should:

- Have a robust integrated weed management plan in place to ensure they were seeding into clean paddocks;
- Carefully select paddocks and crop types carefully – choose those you would still choose to seed into even in a very late break; and,
- Keep input costs low, particularly for fertiliser, to reduce break-even yields.

The dry seeding research was conducted in WA by CSIRO, the Department of Agriculture and Food Western Australia (DAFWA) and Planfarm.

FIGURE 1: This diagram illustrates how opening rains at Mullewa in WA's northern wheatbelt, have become more variable in recent years



The blue bars show the period of time over which the first 10 days of wet seeding (representing the 'break of the season') occurred from 1957 to 2010. In the past 10 to 15 years the break of the season has happened later, and there have been some years wh

Grazing tolerant lucernes identified in long-term trial

LUCERNE has a lot going for it. Often called the 'King of Fodders', lucerne is very drought tolerant, very deep rooted, very productive and very nutritious. It's valuable for grazing, hay or silage. It can fix up to 300 kgs of nitrogen per hectare per year. And to top it off, it's fire resistant.

Lucerne does have some limitations, and tolerance to hard or continuous grazing has been one of them. But by choosing the right cultivar and managing it correctly, producers can now strike the right balance between persistence, yield, quality and animal health.

James Sewell, Research Agronomist at PGG Wrightson Seeds, has conducted a long term trial to identify the most grazing tolerant lucernes.

That's how James Sewell, Research Agronomist at PGG Wrightson Seeds, began his presentation about the strengths of lucerne, and where and how the grazing tolerant cultivars can successfully fit in an operation.

As part of the open day in November last year at the PGG Wrightson Seeds Research Station just outside Ballarat, James spoke to over 130 primary producers and agronomists from around Victoria, South Australia and Tasmania about grazing tolerant lucernes and the long-term research he has been part of to identify the most persistent cultivars.

Five year lucerne persistence trials

James showed producers around the trial site where more than 40 lucerne varieties have been part of a trial looking at their persistence over five years, including six months of set stocking.

James and the participants got down to ground level to observe and identify some of the traits the trial identified.

"All lucernes are drought and grazing tolerant and will persist if managed correctly, irrespective of dormancy group. But some varieties and dormancy groups will tolerate 'poor' or prolonged grazing management better than others," James said.

"Ideal grazing rotations would be for two to three weeks maximum, with a spell of around 35 days. This provides a reasonable compromise between competing factors. But many Australian producers find 'ideal' grazing management techniques impracticable and push those boundaries.

"Identifying which lucernes will persist when grazed for lengthy periods and still produce quality feed has been the objective of our long term trial."

James also explained that grazing tolerance is more complicated than simply dormancy ratings. He talked about the variety of physiological factors that contribute to grazing tolerance.

"The maintenance of root carbohydrates, the maintenance of leaf area under grazing, broad crowns, sub-surface budding, creeping roots, high stem numbers and extended periods of budding all have a part to play. Lucernes that combine the greatest number of these traits are the most grazing tolerant," James pointed out.

To identify the most grazing tolerant varieties, Wrightson Seeds have previously trialled 24 lucerne lines screened and selected by CalWest in the US against 18 Australian standards. Replicated trials were planted in Ballarat and Gundagai. After four years of rotational grazing and gathering data, the Ballarat site was subjected to heavy set stocking at a rate of 40 sheep per hectare with a two month spell after 10 months.

The Gundagai site suffered extreme drought during this time, so final selections were made with the confidence that conditions were as tough as lucerne is likely to come across. The data clearly identified two varieties that proved worthy of the title 'grazing tolerant'.

Two grazing tolerant lines

"Stamina GT6 was chosen because it had the ideal balance between yield and persistence. It has a long growing season, while maintaining high quality," James said.

"Stamina 5 was chosen as the ultimate grazing lucerne. Nearly 100 per cent of plants were alive and bounced back after heavy set stocking. A little more winter dormant than Stamina GT6, it still provides high yields and bulk hay cuts in summer," he added.

"All lucernes will grow best when allowed to replenish energy reserves by spelling for four to six weeks after grazing or cutting. The two Staminas are no exception. But where many varieties will thin out and die if grazed for lengthy periods, our research shows these two varieties are likely to persist under 'abusive' conditions."

For more information: Wrightson Seeds, 1800 619 910. ■

Some of the lucerne plots at the PGG Wrightson Seeds Research Station at Ballarat, where more than 40 varieties were tested over five years and under harsh conditions.

Grains forum prepares industry for season 2011

AGRONOMISTS, researchers, growers and other industry stakeholders came together at the Young Services Club recently to discuss the 2011 cropping season.

Experts from throughout the nation attended the two-day Grains Research and Development Corporation (GRDC) Adviser Update, designed to prepare the southern New South Wales grains sector for the year ahead.

GRDC Southern Regional Panel chair David Shannon said unseasonal weather across the state had meant that growers were facing challenges they hadn't seen in many years, such as cereal rusts, locusts and blackleg in canola.

"Moist conditions have provided perfect environments for fungus and bacteria to thrive, so it was important to present as much information on controlling these issues as possible," David said.

"Pulse and canola disease authority Kurt Lindbeck, from NSW Department of Industry and Innovation, stripe rust expert Col Wellings, from the University of Sydney, and the Queensland Government Department of Employment, Economic Development and Innovation's Greg Platz all delivered presentations to assist growers respond to these threats.

"One of the major concerns for local growers is increasing resistance to herbicides and fungicides being seen in many crops. Chris Preston from the University of Adelaide emphasised the importance of rotating chemicals to minimise resistance and techniques to effectively control outbreak.

"With global events having a growing impact on local farmers, it's more important than ever for farmers to have an understanding of the global market. It was therefore valuable to have Ron Storey from Storey Marketing Services present an update on the worldwide market, and what issues growers will need to keep an eye out for in 2011.

"High yields across most of the state have taken a lot more nutrients out of the soil than in previous seasons, and Jim Laycock from Incitec Pivot discussed what growers need to do to prepare their soils for their next crops," David said.

Southern region *Seed of Light*

The grains industry also took the opportunity to recognise Professor Colin Wellings for his ongoing work on stripe rust by presenting him with the GRDC Southern Region's *Seed of Light* Award. Prof Wellings has dedicated the past 30 years to research and advisory roles relating to stripe rust and, just as importantly, being readily accessible to growers to deliver real-time information as outbreaks occurred. ■

WA *Seed of Light* award winner

ENTHUSIASTIC, energetic and positive are words which have been used to describe Geoff Fosbery, the 2011 recipient of the GRDC western region *Seed of Light* Award.

The Northam-based farm consultant, known widely as 'Fos', received the award at Perth's Agribusiness Crop Updates, a joint Department of Agriculture and Food (DAFWA) and GRDC event.

GRDC western panel chairman and Kojonup grower Neil Young said that in addition to his work as a private farm consultant with ConsultAg, Geoff was generous in sharing information broadly with the WA grains industry, and a strong leader.

"Fos understands what drives a farm business, and has a knack for presenting relevant information to farmers in a useful way," Neil said. "He is a deserving winner of the *Seed of Light* Award, which is presented annually to someone who makes a significant contribution to communicating the outcomes of research."

Neil said Geoff was an effective communicator with farmer and agribusiness groups.

"In 1997, Fos and a group of local farmers formed the Kellerberrin Demonstration Group which has been involved in on-farm research in areas including crop row spacings, plant available water and development of the *Yield Prophet* computer model," he said.

Neil said Geoff worked closely with research and development institutions and regularly spoke at research conferences including the Agribusiness Crop Updates. He was an active participant and contributor to the GRDC's Agribusiness Trial Extension Network, which funded a series of research projects aimed at addressing local problems in local regions.

"One project currently funded under this initiative, with which Fos is involved, is investigating ways of improving sustainability and reducing risks associated with growing cereals in WA's low to medium rainfall areas," Neil said.

GRDC western panel chairman Neil Young and GRDC western region *Seed of Light* Award winner Geoff Fosbery.

Geoff began his career in 1981 as an agricultural adviser at DAFWA's Dryland Research Institute in Merredin, before becoming officer in charge at the department's Three Springs office. In 1990 he was employed as a regional agronomist with Elders, based in Northam, before establishing his own business, Farm Focus Consultants, in 1992.

In 2008 Geoff's business joined the ConsultAg Group which provides technical, marketing, financial and business planning advice to farmers. ■

Global weather and grain markets

■ From *ProFarmer* Australia, March 17, 2011

WITH so many macro-economic factors impacting on grain futures during March, let's focus on the weather 'fundamental' to get an insight into what future global grain production prospects are likely to be.

Big warm-up in Canadian prairies

Temperatures in the western Canadian provinces of Alberta and Saskatchewan have been slowly warming up, with current temperatures of -8°C, compared to -24°C last week. Forecast is for a more mild 0-1°C, beginning the slow process of melting the thick snow pack. Delayed planting is the main concern six weeks out from the spring planting window.

US Midwest warmer weather forecast

Temperatures in the corn belt are also warming up after winter, with some regions hitting 12°C, compared to the prevailing cold weather which has been common of late. Heavy snow still covers the northern corn and spring wheat states in the Dakotas, Minnesota and Wisconsin. The extended range forecast is for very wet conditions even pointing to flash flooding from rapidly melting snow in the Upper Midwest.

Heavy Russian snow ideal for grain prospects

Heavy winter snow in the key southern Russia Volga grain district is forecast to completely restore ground moisture for spring grains. Ideally, snow needs to melt very slowly optimising absorption into parched paddocks. If spring comes on slowly less grain may get planted, the growing season would be shortened and harvesting delayed. The pressure is on for a favourable spring grain harvest, particularly after drought-ravaged winter wheat plantings were reduced by 15 per cent last year.

South America soybean harvest delays continue

Brazil will see regular interruptions to harvesting during the next two weeks as frequent showers and thunderstorms move across the region. The northwestern part of the country will be wettest through the middle of next week. Argentina will experience net drying during the next two weeks with only a few rounds of well-timed rain that will benefit late double-cropped soybeans.

Is La Niña weakening?

Sharp warming in the northern latitudes is becoming more apparent in northern and Eastern Europe, Russia and the China Manchurian Plain. This is significant. A sudden shift toward warmth may indicate that La Niña, is finally dying out. Supporting evidence for a fading La Niña comes from the equatorial Pacific Ocean where sea surface temperatures have begun warming in recent weeks. The faster that La Niña dies out the better the chances for timely spring planting in northern areas. ■

Domestic grain market outlook

Wheat

New season prices have come off their recent highs, but the reality is that a target track price of $280–$290 per tonne port should be fully profitable for most growers. Swap prices are now under $305/t, and if basis comes in under zero, it puts prices close to our target.

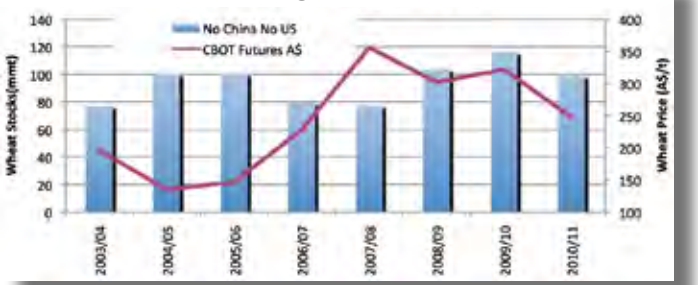
Growers need to confront the decision, do we forward sell or not? If they are going to forward sell they need to have a sensible target for making sales. Even if we trade back to 900 US cents, we are only likely to see swaps trade at $330/t, so targets of $340–$350 etc are going to be aggressive.

The other reality is that last year swaps expired at A$246/t. If global wheat stocks stop falling, or even increase a little this year, and the same happens for corn and soybeans, why will there be a year on year increase in global wheat prices? That gives the downside risk some perspective.

Even if global stocks continue to fall, would a $100/t year on year price increase be overdoing it at current wheat stock levels? Probably. That puts some perspective on the upside potential.

Only when stocks outside of China and the US drop below 80 million tonnes do we get 'really high' wheat prices. If this measure of stocks builds in 2011 it will be negative for prices.

Wheat stocks – excluding China and US



Sorghum

The Australian sorghum harvest continues to cruise along as a result of the bigger acreage in this year – the amount already harvested is high.

Only a few late sorghum crops are still green, with yields very good right through from Dalby to the Liverpool Plains. Harvest pressure has eased on growers due to recent rain events and the market is looking to price lower on similar pressure when harvest recommences.

Sorghum track bids have taken the brunt of the lower corn futures and lack of demand from domestic customers during this period. CQ rail services are operational and have capacity to meet scheduled export demand over the coming months.

Delivered bids have eased to a level where grower selling may just stop for the moment.

Brisbane sorghum lowest price since December 9

Canola

Compared to new season wheat and barley prices, oilseeds have fared the worst over the past seven days. East coast (NSW, Vic and SA) 2011–12 prices have declined $24/t, while Winnipeg Jan 12 futures have fallen away more at C$28/t.

These losses will be further compounded by the March 16 massive sell-off with soybeans (–70c/bu) and canola (–C$30/t) finishing limit down, amidst ongoing concerns about the Japanese economy.

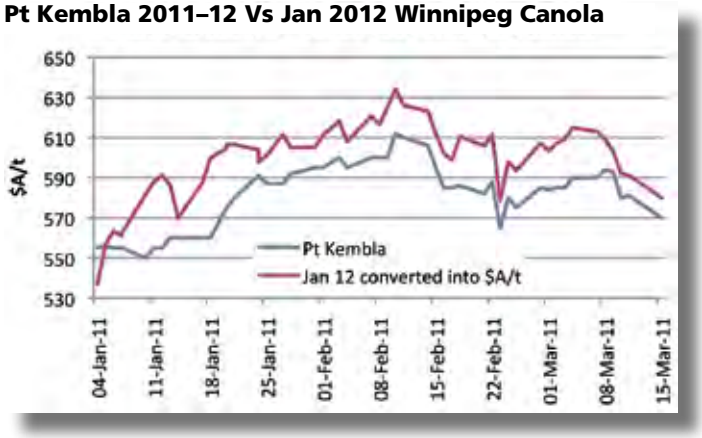
The uncertainty about the global economy and health of the Japanese economy (already on its knees) is currently bearing heavily on the market, with thoughts that Japanese demand for commodities will drop and investors appetite for risk disappearing.

This knee-jerk reaction of the grain markets seems a bit over the top, considering no export business is lost (still tendering for grain in fact) and no major grain discharge terminals have had major damage from the earthquake. But massive speculative selling and subsequent volatility reigns supreme. But as we learned in Economics, "cool heads should prevail and it never pays to sell in a market that is in freefall".

Looking elsewhere for some fundamental factors that could weigh on the market, it seems the Brazilian soybean harvest is still running into wet weather and delays. Consultants are estimating 1–1.5 mt of soybeans have been lost or damaged to date. Harvest is also running behind schedule, with only 25 per cent in the bin, compared to 40 per cent this time last year.

The trade will continue to monitor South American harvest progress, as well as short–term demand for future price direction.

Pt Kembla 2011–12 Vs Jan 2012 Winnipeg Canola



Supplied March 17 by *ProFarmer* Australia. Information available at www.profarmer.com.au or call 1300 302 143

International grain market

By Daniel O'Brien, Extension Agricultural Economist, Kansas State University

FEW changes were made in projected US supply and demand balances for wheat, feedgrains and oilseeds in the March World Agricultural Supply and Demand Estimates (WASDE) compared to the February report.

But some important adjustments were made in foreign crop supply–demand projections that indicate rationing of crop usage on the one hand, and some improvement in foreign crop prospects on the other.

Wheat markets

The USDA lowered projected 2010–11 US wheat exports to 34.7 million tonnes (mt), due to more world export competition and a slower than expected export pace.

Increased wheat crop prospects in Argentina, Australia and Saudi Arabia offset lesser prospects in the European Union. Reduced wheat production prospects in Kansas and other parts of the US Great Plains will impact US supply–demand balances.

If, due to various causes, the US central and southern plains 2011 wheat crop is reduced by 5 to 10 mt or more, it will tighten US wheat supply–demand balances, and have a negative impact on world supplies of exportable food quality wheat in 2011–12.

Corn and grain sorghum markets

World coarse grain supply–demand balances indicated rationing of use is occurring for higher priced feedgrains, as well as the increased use of some lower quality feed wheat as a substitute in feed rations – both in the US and abroad.

As has been the situation since the 2010 harvest, market fears about even further tightening of 2010–11 US corn ending stocks (to less than 17 mt) and ending stocks-to-use (to less than 5.0 per cent) in the spring and early summer of 2011 is likely to continue to support US corn and grain sorghum prices.

Any weather production threat to US feedgrain crops during the 2011 growing season is likely to cause extreme price volatility. Tight corn stocks provide a strong impetus for increased US corn acreage in 2011.

World wheat

World wheat production and total supplies are projected to be 648 mt and 895 mt, respectively, in (marketing year) 2010–11.

The production estimate was raised 2.2 mt and the supply estimate up 1.9 mt from the February WASDE report.

Total world use of wheat is projected to be 663 mt in 2010–11, down 2.2 mt from the February report, but up from 652.5 mt in 2009–10 and 642 mt in 2008–09.

Since 2004–05, food, seed and industrial use of world wheat has grown steadily from 499 mt to a projection of 539 mt in 2010–11 (Figure 1).

World wheat exports ranged from 112 to 117 mt from 2004–05 through 2007–08, but then increased markedly to 144 and 136 mt in 2008–09 and 2009–10 respectively.

World wheat exports from 2010–11 are projected to be 123 mt. But food, seed and industrial use of world coarse grains (including ethanol production) has increased steadily during this period, from 355 mt in 2004–05 to a projection of 471 mt in 2010–11.

Similar to exports, world wheat feed and residual usage ranged from 98 to 113 mt from 2004–05 through 2007–08, but then increased to 118, 117 and a projected level of 123 mt for the 2008–09 through 2010–11 period, respectively.

World wheat ending stocks are projected to be 181.9 mt in 2010–11, up 4.13 mt from the February WASDE report, and representing 27.4 per cent ending stocks-to-use. World wheat ending stocks in 2010–11 are down from 197.3 mt (30.2% stocks-to-use) in 2009–10, but are higher than the 167.2 mt (26.1% stocks-to-use) in 2008–09.

Current world wheat ending stocks are 57.1 mt larger than in the benchmark low supply year of 2007–08 when stocks fell to 124.8 mt and 20 per cent ending stocks-to-use.

Total use of world wheat is projected to have increased from 607.7 mt in 2004–05 to 663.0 mt in 2010–11 – an average growth of 9.2 mt or 1.5 per cent per year.

All the various types of wheat are included in this total, such as hard red winter, hard red spring, soft red winter, white wheat, and durum wheat varieties. ■

FIGURE 1: Trends in world wheat use and ending stocks

Source: USDA World Agricultural Supply and Demand Estimates (WASDE Report), March 10, 2011

Harvesting moist grain pays a premium

EASTERN Australia's 2010 wet winter crop harvest has led grain storage specialists to urge growers to "push the envelope" when it comes to harvesting grain at higher moisture to capture greater financial returns. They say growers have to overcome the psyche that cereal harvesting can only start at 12 per cent moisture.

Andrew Kotzur, who runs grain storage construction company Kotzurs, has urged growers to look at the success of farmers in Europe and America – who regularly harvest at 20 per cent moisture and above, and air dry grain to lower it to meet buyer requirements – as something which could be achieved in Australian conditions. He cites examples in 2010 of northern NSW growers harvesting wheat early at 15 per cent moisture prior to the onset of wet weather, ensuring premium quality and achieving a $200 a tonne premium over the feed wheat which resulted from weather damage.

"We are standing on the edge of a cliff in many grain growing regions – not knowing if we are prepared to jump and start harvesting grain at 14 per cent moisture and higher," Andrew says. "Research has long proved this is not a problem and with good aeration facilities a degree of management is returned to the grower in challenging conditions.

"I took phone call after phone call in 2010 from growers asking if 14 per cent moisture was too high to bring the header in. But if you have aeration capabilities in your grain storage, bringing it back to 12 per cent becomes quite simple and it's a form of insurance for a crop which has cost a lot of money to grow."

Victoria based grains storage researcher and consultant Peter Botta, of PCB Consulting, supports Andrew's comments after

Good storage and aeration capability allows growers to take more control at harvest time.

facing two months of continual telephone enquiries from growers seeking advice on storing moist or weather damaged grain.

"The issue is even bigger than just having the facilities to dry grain out – in much of eastern Australia growers don't even have adequate facilities to just store and manage grain," he says.

"While we might think the last harvest was wet there seems to be a pattern emerging in the past four years of wet weather or summer storms affecting harvest."

More than just grain quality benefits

The benefits come from not just having a higher quality grain but also from being able to start harvesting earlier – which is attractive to contractors; harvest for longer periods of the day; and, if the cereals are harvested early growers can then move on to pulse crops, which quickly decrease in value and yield when weather damaged.

The issue goes even further, according to Peter, who believes there are social and health implications from long, drawn out harvests impacting on rural families, communities and businesses.

"After 12 continuous weeks of harvest some farmers are not nice to be around."

"After 12 weeks of harvest some farmers are not nice to be around. Part of that is because of the lack of control over their environment. But having more and better grain storage gives them back some control," he says.

"Timeliness has been proved to be one of the most crucial aspects of good farm management. Better timeliness of harvest means more timeliness when it comes to spraying summer weeds or preparation for sowing."

While Kotzurs have anecdotal evidence of Australian growers harvesting grain successfully at 18 per cent, trials at the Kotzur Walla Walla facility in southern NSW, have shown wheat harvested at 16 per cent moisture can be efficiently dried to 12 per cent moisture while retaining quality.

The key to success is having the system that allows you to manage the harvest properly. Aeration cooling and aeration drying are very different and planning and correctly managing the harvest and storage system is essential.

Growers planning to start harvest earlier due to a looming wet harvest period, limited contractor availability or a large area have numerous options:

- To seek markets which are prepared to take delivery of higher moisture grains, such as the stockfeed milling market.
- To harvest grain and store grain at 14 per cent moisture and hold it at that level using cool aeration for a period before blending with drier grain for delivery.
- To harvest grain at a high moisture content, store it in a drying silo and, using high flow aeration, dry it down over a period of days or weeks depending on the atmosphere's humidity.
- To harvest grain at high moisture content and dry it quickly by passing it through gas or mechanical dryers attached to the storage complex.

Silo drying grain

To maintain grain moisture content costs approximately 10 to 20 cents per tonne per month and to silo dry grain costs around $1–$2 per tonne depending on starting moisture and humidity levels. Using a gas or mechanical dryer (which generates hot air to be circulated through the storage facility) costs about $5–$8 per tonne.

The Kotzur drying silo uses a specially developed and patented drying cone/plenum. The air is forced into this plenum and then passes through the grain mass. Different drying silo models, fan combinations and grain have varying specifications; but the typical airflow is 25–50 cfm air flow per tonne of grain or a complete change of air in the silo each 25–50 seconds.

This airflow is 10 to 15 times that achieved using conventional aeration.

Purchased for lower capital cost than conventional grain dryers, drying silos offer lower energy consumption, less grain handling, gentle drying and fast aeration without needing screens or perforated floors which can restrict airflow or need cleaning.

The moisture content that grain will dry to is determined by the average condition of the air used. To calculate if air of a certain quality will or will not dry grain, growers can refer to the *Equilibrium Grain Moisture Contents* table (go to www.grdc.com.au or www.storedgrain.com.au) or use an automatic drying controller – which are generally fitted to most new drying silos.

Aeration is not a set and forget exercise with silos regularly needing inspection – particularly if high moisture grain is involved. Fans, ducts, vents and controllers all need to be checked regularly and a sweet fresh smell should be detected around the silo. A musty/mouldy smell can indicate a problem with air circulation within the grain.

More information: www.kotzur.com or pbotta@bigpond.com ■

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NEW HOLLAND AGRICULTURE

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Doing it better

Wayne, JD and Edwin Dulaney, standing in one of their rice fields yielding more thon 200 bushel per acre (10 t/ha). All the rice seed they sell is grown on their farm .

IN the early 1970s, brothers Edwin and Terry Dulaney were proud to be the third generation working the ground their grandfather and his brother cleared for timber and began farming in 1913. They followed the same hands-on "do it right" approach to farming that began when that first ground was broken.

As Edwin and Terry managed the operation near Clarksdale, Mississippi, they wanted a way to keep their good help employed year-round, and to generate more income. Growing higher value seed crops – rice, soybeans and wheat – they reasoned, could be the answer.

"We knew we were growing crops that could provide good seed. We didn't have to change any agronomic practices, as we always tried to maintain high standards," Edwin recalled.

Dulaney Seeds was formed in 1991 and continues today with Edwin's sons, JD and Wayne, continuing a couple of family traditions – seed production, hands-on operation, ag education at Mississippi State University, and a desire to always do things better.

"Not all our cropland is in seed production, but we treat it all like it is," JD explains.

Today, the Dulaneys operate as two businesses: Dulaney Seeds, and their farming operation, 'Gen 4 Farms' named to recognise their spot in the farm's progression.

Gen 4 Farms encompasses about 5900 acres (2390 ha), nearly all irrigated, and grows all the rice, and most of the soybeans labeled as Dulaney Seeds. Their seed wheat also comes from their farm, as well as from contracted growers.

Having the seed business has given the Dulaneys reason to structure their operation a bit differently. Edwin and Terry have semiretired from the farm and actively promote Dulaney Seeds, working with university researchers and managing seed plots throughout the mid-South.

JD manages overall farming operations, and Wayne serves as lead agronomist for Dulaney Seeds. He also handles the farm's agronomic and marketing needs.

With all four family members focused on efficient, high-quality seed production, they're quick to adopt practices and equipment that will make a difference.

Timeliness is critical

Timeliness underpins everything. Edwin says his father emphasised two things: Have good planting equipment and more harvesting equipment than you think you'll need.

To that formula, they've added autoguidance and site-specific precision farming capabilities.

"For overall efficiency, I'd say autoguidance has been our single biggest improvement," JD says. They invested in autoguidance in 2002, and found they could plant 1600 acres (650 ha) of soybeans in the same amount of time with two tractors and planters that previously took three, JD says.

Another autoguidance advantage, he says, is doing precision bedding and planting. "We can put in a lot of hours and still do a good job." They plant with a pair of Case IH 1200 Series planters, set up to plant 17 x 30-inch (76 cm) rows, with their two MX275 tractors set to clear 90-inch (2.3 m) rows. This tyre setting provides ample clearance for mud when the tractors are working in rice.

"We're rowing 12 rows, planting 17 rows and harvesting eight

rows," Edwin says. "Autoguidance has done away with the need to keep everything on the same row pattern."

They've used the accuracy of autoguidance to introduce other efficiencies. As their rice fields are precision land formed to manage water with straight levees, rather than contoured ones, JD sets his autoguidance in the tractor used for rice seeding to make six seeding passes, automatically skip 8 feet, then make six more seeding passes.

"That 8 feet is where the levee goes, so I'm not planting ground I'm going to chew up with the levee plow. I'm saving that seed," JD says.

In corn, Wayne says he strives for a net effective plant stand of 95 per cent, and to make every ear fill out. "That's what you need to get the higher yields," he says, noting that most growers likely average 75 to 80 per cent net effective stand in good corn.

The difference, Wayne says, includes giving the plants a good start. "We put down starter fertiliser with the planters, then come back shortly after emergence with a close sidedress of nitrogen," he says. Running injection knives on both sides of the plant, just 5 inches (12.5 cm) away, is another application where autoguidance enables on agronomic practice that would be much more difficult without it, JD notes.

Every year, the Dulaneys look for more ways to bring precision farming practices into the operation. With more than a decade's worth of yield maps as reference, they're able to closely evaluate the cost/benefits of spray applications, fungicides and foliar feeds, and to make variable-rate applications of P and K.

Not that all their work is done by machine. To assure the purity they maintain for their Dulaney rice varieties, their rice fields are hand-weeded by crews several times during the growing season. "We manually remove the off-types," Edwin says. "Every acre is walked at two different stages."

Like other mid-South farmers, the Dulaneys' desire for ample harvest capacity has been shaped by a hurricane or two. The year Hurricane Rita come through, they had purchased a new Case IH 2388 Axial-Flow combine, and kept their older 2188, rather than trading it. "I didn't think we'd need it, but it was paid for, and we figured it would be helpful if we added more acres," Edwin recalls.

As it were, they ran the two machines hard to finish all their rice the day before the storm. "Fields that were still standing were laid down flat like a roller went over them. You don't forget things like that," Edwin says.

Now, they' re running four Axial-Flow combines: one 2188, two 2388s and a new Axial·Flow 8120 on tracks. They had 'demoed' an 8120 when it was introduced, and liked it. During 2009's wet harvest, Edwin says they saw how an 8120 on tracks performed "while we were struggling with the mud, making a mess and getting stuck," he says.

That experience, plus their recent acquisition of additional land, prompted them to buy the Axial-Flow 8120 on tracks for 2010's harvest. "I've gotten into some mud with this machine and never knew it," JD says. "For us, in rice, it's doing what two and a half 2388s will do."

Only accept seed from Axial-Flows

As seed growers, the Dulaneys go way back with Axial-Flow combines because of their ability to deliver whole grain and clean samples. Wayne says he also saw the difference as he took twice daily samples from the combines of growers who grow some of their seed soybeans.

"We only accept seed growers with Axial-Flow combines," he says. "On other combines, the best I could get them to was about 92 per cent uncracked seed, so that's starting with 92 per cent germination. With the Axial-Flows, we can get 98 per cent or better. There's a knack to setting them up, but once you learn on Axial-Flow combine, it's probably the simplest system out there."

JD says their initial experience with the Axial-Flow 8120 has shown it easier to clean out for the inspections by a seed improvement association inspector required each time they move to another field. "There are doors at the bottom of the augers, and it's more open overall. Cleanout takes much less time."

The Axial-Flow 8120 on tracks is the latest in the long line of improvements and practices that help the Dulaneys do a better job of farming.

Other examples include their ability to capture excess flood irrigation water and apply to several more fields before it's played out, thanks to a lock-and-dam type drainage system, and the specialised grain handling and storage structures that JD designed and built as a certified pipe and plate welder.

They handle a lot of their own shopwork, but with the equipment's increased level of technology, they increasingly count on their Case IH dealer for service and for advice about the equipment that will work best for them. ■

On tracks, the Dulaneys' Axial·Flow 8120 combine handles pavement as well as it does the muddy field conditions they bought it for. As seed growers, they see firsthand the advantage of the Axial·Flow threshing system delivering a clean, whole sample.

NEW BIOTECHNOLOGIES UNVEILED AT INTERNATIONAL CONFERENCE

In January 2010 Dr Emma Mace, a member of the Sorghum Breeding Program staff at Hermitage Research Station (DEEDI) near Warwick in southern Qld, was awarded a GRDC travel grant to attend the XVIII Plant and Animal Genome (PAG) Conference in San Diego, California.

As well as the conference, Emma attended concurrent workshops and presented a Poster on: 'Bridging the gene to phenotype gap: a set of integrated resources for sorghum' (see page opposite), highlighting research activities on-going at DEEDI and with collaborators at the University of Queensland.

A highlight of the PAG Conference was the unveiling of new technologies that have the potential for significant impact on sorghum research and breeding activities in Australia. The DEEDI sorghum breeding program is undertaking research to ensure the relevant utility and application of new technologies to the grains industry.

Third-generation sequencing

US based biotechnology company Pacific Biosciences, detailed a world first at the conference with the development of a third-generation sequencing machine. The third-generation sequencing technology – also termed single molecule real-time (SMRT(R)) detection of biological events – enables, for the first time, the observation of natural DNA synthesis by a DNA polymerase as it occurs.

SMRT DNA sequencing technology will offer a completely new performance envelope with its combination of long read-length, fast time to result, low cost, and more informative sequence data.

The continued advancements being made in the field of DNA sequencing technologies provide very exciting opportunities for grains research and development.

Dr Emma Mace is a member the Hermitage Research Station (DEEDI) Sorghum Breeding Staff.

Sorghum is particularly well placed to take advantage of these technologies with the recent availability of the sorghum whole genome sequence, allowing more time and cost effective re-sequencing projects to be undertaken.

Targeted mutagenesis

Another new technology unveiled at the conference was targeted mutagenesis using zinc finger nucleases. This allows targeted gene addition, deletion, editing or tuning to alter gene expression.

The technology is classified as non-GMO and offers exciting alternatives to genetic transformation for gene function validation.

Future collaborations

There is a lot to gain from meeting and discussing research directions and results with other international grains researchers. Discussions at the PAG XVIII Conference have led to several potential collaborations with the promise of significant benefits for the Australian grains industry. Some of these existing and future collaborations include:

- Texas A&M University (Drs John Mullet and Patricia Klein): Utilisation of the recently developed Illumina based SNP-genotyping technology for sorghum. This technology could provide a very cost-effective whole genome profiling methodology. Collaborative research projects focused on 'mining' the recently developed mutant population at DEEDI were also discussed.
- CIRAD, France (Dr Jean-Francois Rami): Discussions focused on DEEDI accessing the recently generated whole genome profile data across the CIRAD sorghum core collection, facilitating the assessment of the genetic diversity encompassed within the sorghum breeding program.
- USDA (Dr Robert Klein): Developing and optimising a novel seed-based DNA extraction methodology for sorghum, with the potential to increase sample through-put and decrease total cost per data point. These discussions were in addition to updates on collaborative work to clone two fertility restoration genes.
- DArT PLC (Dr Andrzej Kilian): Stream-lining and optimising DArT data delivery and data analysis to the sorghum breeding program, enabling more efficient use of whole genome profile data generated across sorghum genotypes.
- University of Western Australia (Dr Ian Small): Genome-wide analysis of pentatricopeptide repeat (PPR) proteins, which are involved in fertility restoration. This could lead to an enhanced understanding of the genes controlling fertility restoration – a very important trait for the hybrid seed industry.

BRIDGING THE GENE TO TRAIT GAP

Despite the development and application of new technologies, the challenge of understanding the way in which genetic factors generate complex characteristics or traits (phenotypes) is one of the greatest difficulties facing plant biologists today.

Phenotypes result from the expression of an organism's genes – as well as the influence of environmental factors – and the interactions between the two.

While technological improvements have already dramatically reduced the cost of the 'omics' – such as genomics and proteomics – the costs of generating genetic stocks and phenotypic data continues to rise.

The logistical capacity of crop breeding programs to dissect complex traits and study gene expression across multiple environments is often not available to geneticists. By making use of information that is generated through the breeding program – and taking advantage of new integrative technologies such as crop simulation – we are attempting to efficiently bridge the divide between theoretical and applied applications.

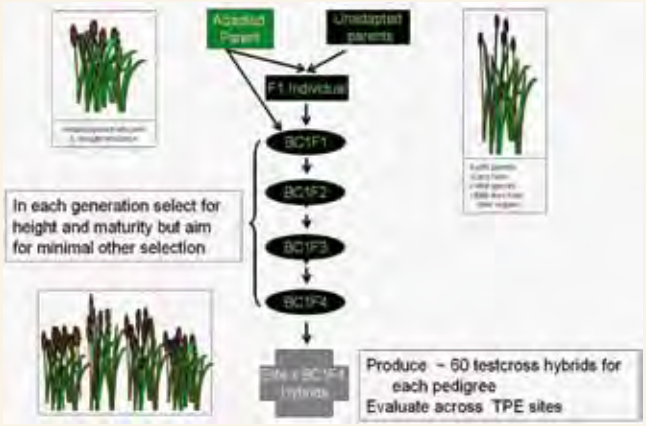
The following describes a set of coordinated germplasm and technology resources – developed by the Hermitage Research Station Plant Breeding Team – to enhance gene function determination in sorghum.

Continued investment in the DEEDI sorghum breeding program, including molecular breeding activities, is required to ensure the relevant utility and application or new technologies to the Australian grains industry.

Nested Association Mapping resource

A NAM resource consisting of more than 4000 sorghum lines from 80 families has been developed and evaluated for a range of traits including stay-green, yield, flowering time and height in a large number of Australian environments. An elite inbred line (R931945-2-2) was used as the reference and recurrent parent, while the 80 non-recurrent parental lines were chosen to represent a sample of the genetic diversity of sorghum.

FIGURE 1: An overview of the breeding strategy used to develop the sorghum NAM populations



Mining sorghum diversity

A member of a pair, or series, of genes that occupy a specific position on a specific chromosone affecting the expression of a particular trait, is an allele. The aggregate of such alleles is called an allelic series.

Allelic series of both natural and induced mutations are available through the establishment of an ecoTILLING population and a reverse genetics mutagenised population.

Genetic and physical mapping

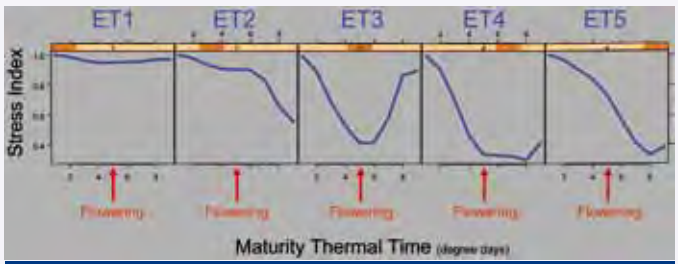
The development of a high density, genetic linkage consensus map, integrating DArT, RFLP, SSR and gene markers – and its alignment with the recently available sorghum whole genome sequence – enables rapid and targeted genome navigation, QTL cloning and gene identification.

Crop simulation modelling

In combination with phenotypic and genotypic data, crop simulation has an important role to play in understanding the control of complex traits. Simulation can be deployed both as a predictive tool and as an aid to analysis.

In our program we use environment characterisation and crop simulation modelling to provide additional value to our phenotypic data.

For more information contact Emma on E: Emma.Mace@deedi.qld.gov.au Department of Employment, Economic Development and Innovation, Qld.



Average patterns of stress index around anthesis for the five major environment types associated with sorghum production in north eastern Australia.

Unprecedented rust risk in 2011

A NEW campaign launched on March 17 by the Australian Cereal Rust Control Program (ACRCP) is encouraging growers to be proactive and plan their 2011 rust management strategy now in response to the worst disease risk in nearly 40 years. The campaign – called the *Rust Bust* – is supported by the Grains Research & Development Corporation and gives growers tips on more effectively managing rust and adopting a 'select and protect' strategy.

ACRCP Consultative Committee chairman Grant Hollaway says where possible, growers need to select wheat varieties that have improved disease resistance and adopt management strategies that protect themselves, their neighbours and their industry.

"This year, wheat growers face an unprecedented risk of stripe, stem and leaf rust because of increased inoculum levels in crops during 2010 and the potential for carryover on volunteer plants – the green bridge – following high summer rainfall.

"Variety selection along with disease management this year will be crucial to minimise disease risk because a rust outbreak can slash grain returns by more than half," Grant said.

"The ultimate goal of the campaign is to encourage growers to phase out susceptible and very susceptible varieties from their rotation where possible but if these cultivars are grown, then farmers need a management plan ready in advance in case of a rust outbreak.

"Growing varieties with resistance to rust is the starting point for rust disease management. Growers must also increase communication with their neighbours to ensure rust management is a group, not individual, effort."

Grant says growers must have a four-part management strategy that extends throughout the year. This includes:

- Removing the green bridge;
- Growing varieties with adequate resistance to the three rusts;
- Applying fungicides on seed or fertilisers for rust suppression; and,
- Monitoring crops for rust and if needed, applying foliar fungicide for disease control.

"The campaign was launched on St Patrick's Day – an occasion known for the colour green – to highlight that growers should now be removing the green bridge," he said.

"A rust outbreak in Australia has the potential to slash farm incomes which is why it is so vital we plan our response to rust this year at the beginning of the season, rather than waiting for a rust outbreak to occur and then planning a control approach.

Think before you sow

Australian Seed Federation's Peter Neilson – a member of the ACRCP Consultative Committee – says rust susceptible and very susceptible varieties must be responsibly managed if they are part of wheat growers' rotation.

"We are working to encourage growers to use all the tools available for rust management – and variety selection is a huge part of that," he said.

"We are happy to be part of this campaign because it brings all parts of the wheat industry together in a united push to reduce our rust risk this year – one of the highest risk years we've ever faced."

The committee's wheat breeder representative, Russell Eastwood, says in the absence of responsible management packages, growing rust susceptible varieties means growers are at risk of losing grain yield and quality; contributing to increased inoculum production which is also likely to contribute to genetic resistance breakdown.

"Australian wheat growers are facing a high risk of significant stem, leaf and stripe rust outbreaks this season," he said.

"While breeding rust resistant varieties is part of the 'select and protect' process, correct management strategies are essential to ensure we protect the genetic resistance we have in our current varieties."

GRDC Crop Protection manager Rohan Rainbow says supporting the *Rust Bust* campaign was a priority for the organisation. "The entire wheat industry – from grain growers through to breeders and the seed industry – must be on the front foot with regard to rust this year to avoid a major outbreak."

The campaign includes a new website – www.rustbust.com.au – which will be a key hub for information on rust. ■

Silicon's key role in plant growth

■ By Austin Smith, Nutrifert

AUSTRALIAN and international plant and soil nutrition research suggests that low levels of the mineral element silicon (Si) in its plant available form, is a major deficiency in our soils, particularly where cereal grains, rice and sugarcane are grown. And because plants, particularly cereals, are large accumulators of silicon during the plants' various growth stages, a lot of silicon is transported out of the paddock in the harvested product. As the seasons roll on, the soil reserves of plant available silcon (PAS) are diminished.

What role does silicon play in plant growth?

Plants typically absorb bio-available silicon as a silicate – generally known as monosilicic or orthosilicic acid.

Silicon is deposited as silica in the plant cell walls, improving cell wall structural rigidity and strength, plant architecture and leaf erectness. Silicon in plants can stimulate nutrient uptake and plant photosynthesis, decrease susceptibility to disease and insect damage, alleviate water and various mineral stresses and decrease the toxic effects of aluminium.

PAS increases the translocation (movement) of nutrients within the plant and increases water efficiency by reducing transpiration. The benefit of a high PAS content fertiliser product is that it delivers organic amorphous Si (as opposed to crystalline Si) in an easily accessible form to the crop root zone.

There has been extensive research both in Australia and overseas investigating the responses of a wide range of crops and soils to applications of PAS.

Silicon applications have been shown to break up a compacted soil to allow air and water to penetrate deeper into the soil, including clays. The water retention has increased via the better soil structure with some trials showing 35 to 40 per cent increases in moisture retention capability.

A Japanese study, published in the *Journal of Plant Nutrition* in August 2008, found that silicon improved hydraulic resistance, allowing the sorghum plants with sufficient PAS to have a better water uptake rate than silicon-deficient sorghum under water stress.

Chinese research, also published in the *Journal of Plant Nutrition* in 2003, studied silicon's role in improving wheat disease resistance. The researchers found that soil-applied PAS raised the Si wheat leaf content and improved the wheat plant architecture leading to a higher dry matter yield and reduced spot blotch disease severity.

Silica amendments have also been shown to correct soil toxicities from high levels of some elements such as Mn (Manganese), Fe (Iron) and Al (Aluminium).

For example, a collaborative study by Oxford Brookes University in the UK and York University in Canada (Hodson and Sangster) found that sorghum seedlings treated with an Al solution had reduced root growth and a significant increase in the shoot/root ratio. But when silica was included in the Al solution, this significantly ameliorated the detrimental effects of Al on root growth.

Other trials have shown that high silica absorption by plants also helps improve drought resistance while increasing resistance to fungi and other pathogens. Better growth rates and improved yields were the result.

In an article published in *The Australian Cottongrower* in 2005, QDPI plant researcher Linda Smith and colleagues described how Si helped ward off disease in cotton (and other plants).

"Silicon is taken up as silicic acid by the root system of higher plants and moves upwards in the transpiration stream to sites of strong evapotranspiration where it is transformed into insoluble polymers," Linda wrote. "Once polymerised, silicic acid is no longer available as a source of silicon for any other part of the plant.

"Improved resistance to disease and pathogenic fungal attack due to Si applications has been reported for a number of crops. As most parasitic fungi penetrate the host by boring through the epidermal cell wall, Si in these walls may act as a mechanical barrier.

"In addition to decreased susceptibility to fungal pathogens (and insects), the beneficial effects of adequate Si include reduced manganese and iron toxicity, reduced salinity and water stress, protection of leaves from ultraviolet radiation damage and increased growth in some plants," Linda added.

More information: Austin Smith 07 5446 6602 or see www.nutrifert.com.au ■

AT A GLANCE

- Silicon fertilisers with high PAS content have many potential benefits and sufficient Si supply aids healthy growth and productive development.
- Applied silicon fertilisers interact positively with applied major and trace elements improving their agronomic performance and efficiency.
- Silicon fertilisers also enhance the plants' ability to resist or tolerate biotic stress such as attack of insect pests and fungal attacks.
- Silicon fertilisers can help alleviate abiotic stresses due to acidity, salinity and toxicities.
- Silicon fertilisers can help reduce water loss and transpiration.

Paddock demonstrations in 2008 at Allora on Qld's Darling Downs, showed greatly enhanced wheat root development in those plants where seed was coated with a silica product (Amorsil Max) at 20 per cent.

Eavesdropping on insect pests

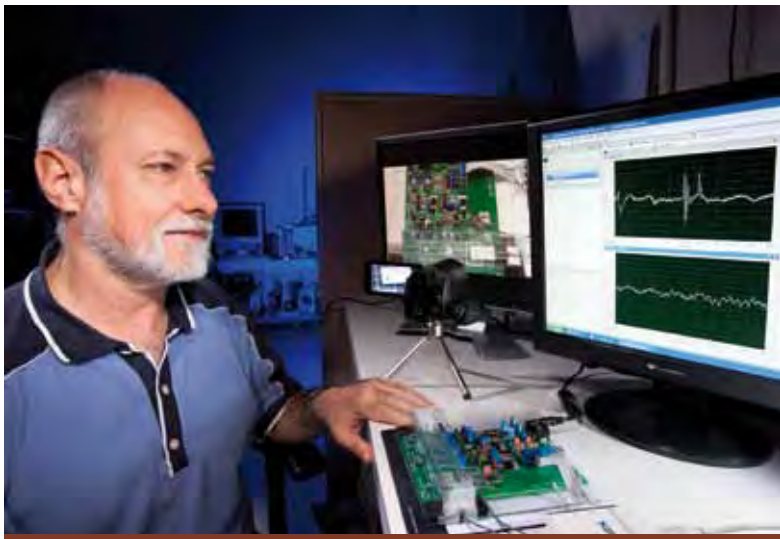
■ By Jan Suszkiw, Agricultural Research Service – USDA

GRAIN silos, warehouses, and food-processing facilities are a hungry insect's delight, thanks to ample food and climate-controlled conditions. Fortunately, there are many effective strategies for keeping stored-product insects in check – including targeting of problem areas with extra sanitation measures and baits. But determining pest whereabouts and numbers in order to effectively implement these strategies can be challenging.

Now, after eight years of research, Agricultural Research Service entomologist Richard Mankin and colleagues may have some inexpensive help. Using commercially available parts, they've built a monitoring device that detects insects by the sounds they make.

Collaborating with Richard are North Carolina State University researchers Ryan Hodges, Troy Nagel, and Coby Schal, all in Raleigh; and Roberto Pereira and Philip Koehler, both at the University of Florida in Gainesville.

The most likely application will be to automate routine monitoring of industrial-scale traps, especially those placed in hard-to-reach areas like crawl spaces or near food-processing equipment. "Automation could be useful in a situation where you have a trap in place for a long time and you don't want to have to check it every week or two," says Richard, at the ARS Center for Medical, Agricultural, and Veterinary Entomology in Gainesville.



Entomologist Richard Mankin examines signals collected by an inexpensive prototype system (on the bench, at his fingertips) for automated insect detection and identification. (PHOTO: Peggy Greb)

Armed with automated traps, silo managers could improve the timing and placement of control measures or even avoid using them when there's no need.

The researchers' insect intelligence gathering isn't restricted to stored-product pests, though. They're also targeting home intruders like *Blattella germanica* (the German cockroach) and *Cimex lectularius*, better known as the 'bed bug'.

Mankin says their objective was to create a device that would make automated insect monitoring not only affordable, but also easy to use and reliable. Toward that end, they integrated commercially available sensors (LEDs, microphones, and piezoelectric film) with high-gain amplifiers and laptop-run software for analysing digital signals.

Their system uses the sensors to collect infrared, acoustic, and vibrational signals generated by three kinds of insect movements: wriggling, crawling, and scraping. The software analyses the signals to create a profile of the target insect that distinguishes it from other species.

The researchers tested their device on three stored-product pests (rice weevil, red flour beetle, and drugstore beetle) and two household pests (German cockroach and bed bug). Individuals of each pest were placed inside small arenas where their signals could be collected and analysed for differences in profile, magnitude, and duration.

Although all five species generated all types of signals, red flour beetles mostly wriggled, German cockroaches typically ran or crawled, and bed bugs mostly scraped.

Richard envisions users placing the devices in traps in or near infested structures and monitoring them remotely via laptop computer. "You would probably receive an alarm when a potential target insect was detected," he says. "The information could also be saved in a spreadsheet, with the time of occurrence and probability that this was a target insect."

Richard Mankin is in the USDA-ARS Insect Behavior and Biocontrol Research Unit, Center for Medical, Agricultural, and Veterinary Entomology, Gainesville, FL 32608; Ph: (+1 352) 374-5774. ■

Orion grower first to gain sunflower accreditation

CENTRAL Queensland sunflower producer Sam Bradford is the first of 74 growers and advisers attending *Better Sunflower* workshops to complete his nationally recognised accreditation. It's been a challenging season for the team at Arcturus Downs Pty Ltd, who have battled record breaking floods, unseasonal rainfall and subsequent outbreaks of feathertop Rhodes grass (FTR).

Sam manages four properties across 34,900 hectares, located adjacent to the Comet River at Orion near Springsure. They have raingrown and irrigated cropping, as well as store and fat cattle.

Sam Bradford, Arcturus Downs, Orion, pictured in a crop of Sunoleic 06 in February.

Sunflowers make up an important part of Arcturus Downs' 6475 hectares of annual dryland operations with 550 hectares of spring sunflowers (Sunoleic 06) ready for harvest mid-March, and 700 hectares of summer sunflowers (Sunoleic 06) planted early March 2011.

Perversely, after the December–January flooding, Arcturus Downs experienced one of its driest January–February periods on record receiving only 46 mm, (mean average rainfall for this period is 212 mm) followed by 70 mm in the first two weeks of March – already greater than the monthly average.

Like many other frustrated growers in Orion, Sam still has country to plant and hopes to sow another 600 hectares, weather permitting, with seed stored over from the 2010 summer plant.

"It's the same as last year – we're waiting and waiting for planting rain, and then working around the clock at the end of the planting window to get the crop in," Sam says.

Comet River in flood: Bow waves break over Arcturus' sunflower crop, 28 December 2011.

Marginal spring crop

The continued unseasonal rain will also delay the spring sunflower harvest. Sam says everything about the spring crop has been marginal. Prior to planting, Arcturus Downs stripped chickpeas from the paddock, and were unable to avoid machinery compaction due to a wet harvest. Then the lowest sections of the paddock were submerged and/or washed away in the 2010 Boxing Day floods.

Despite these hurdles, the crop has maintained what Sam considers a fair plant population and good-sized heads and he hopes the crop will still realise between 0.7–0.8 tonnes per hectare.

Farmers and graziers along the Comet River and its tributaries experienced the worst flood in living memory after Christmas. Arcturus Downs received their first damage in early December when the Orion Creek ran very high and channelled water through the property's irrigation area. When the second wave of record-breaking floods arrived on Boxing Day, the River stretched 5 km across the property.

With the flooding and increased rainfall over the summer season, management of FTR has become a significant problem

for the enterprise. Sam is very disappointed with GRDC's decision to conclude research undertaken on FTR grass in Central Queensland, but is hoping that Arcturus Downs' involvement as a trial partner in the Crop Sequencing Group will help them gain extra information.

Currently Sam believes the only real way to combat FTR is to manage the use of residual herbicides – which sunflower allow. The results from the DEEDI CQ weed research supports his experience.

Management trials demonstrated that incorporating summer sunflower or mungbean in the rotation allowed the use of grass-selective herbicides which were effective in controlling FTR. In conjunction with crop competition, these herbicides could quickly reduce the FTR seed bank.

"That's the key – using residual chemicals like Treflan (trifluralin) to contain outbreaks during summer when it rains and you can't get on the paddock," Sam says.

"We're in the position where, because of the flooding, increased summer rainfall and FTR getting out of control – all of our country that's not under sunflower or sorghum right now will ultimately be cultivated. This will either be for FTR control, or because it's just had so much water over it that the soil is 'dead' from being in that anaerobic environment for a month or so."

This has been a common experience in 2011 as many other growers across the southern highlands cropping district of CQ struggle with the challenge of controlling FTR, and revert back to an older style of farming incorporating additional tillage and managing the associated labour, fuel and time inputs.

Like many landholders along the Comet River, Sam is getting on with the huge task of rebuilding, repairing and replacing flood damaged infrastructure.

Despite the season's challenges, Sam took time out to complete his *Better Sunflower* accreditation in February with *Better Sunflower* Coordinator Liz Alexander.

Sam highly recommends the *Better Sunflower* workshop to other growers and advisers: "I really enjoyed the course – for me it was really interesting, particularly being in the business. I liked the way it followed crop production from start to finish, and it's easy to read back through the pack and find quickly any other information you might be looking for. It was a great way of doing it."

Further information: Contact Liz Alexander 0429 471 511 or bluedogag@bigpond.com.au ■

Arcturus Downs spring sunflower delivers a good result despite a marginal start.

BETTER SUNFLOWER WORKSHOPS

Concluding in Emerald, Central Queensland, 74 growers and advisers have attended the *Better Sunflower* one-day grower and adviser sunflower agronomy workshops. The workshops were also held in Goondiwindi, Gunnedah and Dalby in 2010. Attendees received the latest research and information on the profitable role of sunflowers in the cropping system.

Liz Alexander, *Better Sunflower* Coordinator (jointly funded by Australian Oilseeds Federation and the GRDC) says that all workshops were very well supported, with most fully booked.

"Each workshop was evaluated by the participants who reported across the board that the course and resources were of very high quality. Most importantly, growers and advisers said that the information provided on the day had medium to high potential to improve sunflower productivity and quality within their clients' or their own businesses," Liz said.

AOF has negotiated formal accreditation for the course in partnership with the Australian Agricultural College Corporation and 40 participants, predominantly agronomists, have enrolled in formal industry certification.

The *Better Sunflowers* workshops consisted of modules covering the whole growing cycle, and are tailored to each growing region. Modules included:

- Marketing
- Plant Growth and Development
- Agronomy, including Irrigation Management
- Weed Management
- Disease Management
- Pest Management
- Harvesting
- Storage
- Sunflower in the Rotation

Participants took home the Big Yellow Sunflower Pack, a comprehensive folder containing the latest agronomic knowledge similar in format to the mungbean and chickpea industry course folders.

Liz thanks the many industry members from commercial businesses and government agencies who contributed their expertise and time to present at the workshops:

- Loretta Serafin, District Agronomist, Industry & Investment NSW, Primary Industries, Tamworth
- Stephanie Belfield, Private Agronomist, HMAg, Moree
- Trevor Philp, Pacific Seeds, Toowoomba
- Tony Cook, Technical Specialist (Weeds), Industry & Investment NSW, Primary Industries, Tamworth
- Vikki Osten, Principal Research Scientist (Weeds), DEEDI, Emerald
- Sue Thompson, Senior Technical Officer, DEEDI, Toowoomba
- John Thomas, Principal Research Scientist (Plant Pathology), DEEDI, Indooroopilly
- Kate Charleston, Extension Officer (Entomology), DEEDI, Toowoomba
- Kevin Charlesworth, grower, "Mirradong" Clifton
- Philip Burrill, Development Agronomist Hermitage Research Station, DEEDI, Warwick
- Mark Martin, MarketAg Pty Ltd, Willow Tree
- Meredith King, Queensland Field Merchant, Australian Grain Accumulation, Toowoomba
- Nick Goddard, Executive Officer, Australian Oilseeds Federation, Sydney

Future *Better Sunflower* workshops will be held according to demand, with a maximum of two scheduled for 2011. Interested people can email *Better Sunflower* Coordinator, Liz Alexander, to register their interest on bluedogag@bigpond.com.au.

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SOUTH AFRICAN AIRWAYS

A STAR ALLIANCE MEMBER

Western region

NORTH

Rain has continued for most of the fringing areas of the district with much of the region recording above 100 mm and large areas with above 200 mm. The highest summer recordings are in the north east and are close to 400 mm. The western and south western areas have had the lowest rainfall with around 50 mm common in these areas.

This has created some big challenges with summer weed control, particularly button grass. This weed is relatively new to our area (since 2000) but is now in very high density on most red loam paddocks on the edge of the farming areas and has moved its way onto loam soils in the north of the region.

We have tried all the regular grass control strategies but nothing is keeping this weed down. Follow-up rains are also keeping weeds ticking along and pulling through solid herbicide sprays. We have drastically reduced the overall weed biomass and retained soil moisture but we are achieving suppression of button grass instead of control.

Spur-throated locust have come into the region from the north and may prove a challenge as we get into April and crops start to emerge. Nymphs have been emerging in fringe areas for a couple of weeks so they are likely to persist for a few months yet. Anyone out there with a solution to these, please let me know.

Outside of pondering these problems growers are busy burning stubble windrows (or trying to!) and getting equipment ready for seeding. I expect the first crops will go into the ground in mid April and many areas will have enough moisture with no more rain to get crops up in five weeks! Hopefully a well timed inch of rain on April 10 will get our season off to a perfect start.

Button grass 20 days after application of 4 litres per hectare of Roundup PM + LI 700.

Peter Norris
Agronomy For Profit and Synergy Consulting, Geraldton
March 9, 2011

SOUTH COAST

Seasonal conditions on the South Coast have been mixed. For growers west of Esperance there has been some very good rainfall over the past two months with anywhere from 50–100 mm being recorded. This rain has also extended north to Lake King and Varley.

As a consequence there has been a good germination of summer weeds which are presently being sprayed out. The positive is that these areas now have good levels of stored soil moisture.

The contrast is the areas north and east of Esperance where very little summer rain has fallen. These areas are becoming very desperate for stock, domestic and spraying water.

Apart from spraying summer weeds, growers have been busy with budgeting and farm plans and other jobs such as gypsum and lime spreading, clay delving, spreading and spading on the non wetting sands.

Most farm budgets are looking good providing rainfall this season is at least average and the grain and livestock prices remain buoyant.

Quenten Knight,
Agronomist Precision Agronomics Australia
March 4, 2011

TOP: A clay pit at Condingup about 80 km east of Esperance. BOTTOM: The pit provided enough clay for spreading over about 40 hectares.

Southern region

SOUTH AUSTRALIA

Weather

- Warm to hot during January with several very hot days late in the month; maximum temperatures above average in the north and near average further south and minimum temperatures above average throughout.
- Mild to warm and occasionally hot during February with a few very hot days during the month; maximum temperatures mostly below average and minimum temperatures above average throughout.

Rainfall

- January rainfall varied from below average to near average in western and central districts to well above average in eastern border areas as a result of tropical moisture infeed mid month. Several centres had their highest January rainfall on record.
- February rainfall was well above average across the state as a result of moisture associated with tropical cyclones feeding in during the month. Many centres had their highest February rainfall on record.
- Summer rainfall (December-February) was well above average across the state.

Crops

- Harvest was largely finished during January, although ongoing rainfall delayed completion until late February in South East districts.
- Heavy rainfall in both January and February resulted in localised flooding in a couple of districts.
- Yields were generally very good, but grain quality was significantly affected as a result of rainfall during harvest although the extent of weather damage was extremely variable.
- Summer rainfall was well above average resulting in high levels of soil moisture much of which should be available for the coming season.
- Farmers have been spraying summer weeds including crop volunteers to conserve moisture and nutrients, clean up paddocks and lower disease risks. Paddocks in some areas have already been sprayed more than once.
- Stubble management has started to get underway as farmers work to get on top of the heavy stubble loads and prepare paddocks for the coming season.
- Locust activity was reported in a number of districts and will need to be closely monitored in the lead-up to seeding.

Seasonal rainfall across the grain regions – 25 year averages and year to date

Brought to you in association with JOHN DEERE

	25yr Annual Average (mm)	2011 rainfall to date (mm)	Summer		Autumn		Winter		Spring	
			25yr Annual Average (mm)	2010–11	25yr Annual Average (mm)	2011 to date	25yr Annual Average (mm)	2010	25yr Annual Average (mm)	2010
Emerald Qld	556	135	247	345	105	54	69	78	126	285
Toowoomba Qld	644	576	239	860	135	55	85	126	173	250
Roma Qld	576	156	226	357	120	33	78	93	143	289
Goondiwindi Qld	619	151	239	227	135	37	105	161	139	255
Narrabri NSW	654	109	229	286	128	0	134	146	157	224
Gunnedah NSW	677	115	223	325	131	19	128	213	178	258
Dubbo NSW	616	63	191	214	133	17	133	157	154	250
West Wyalong NSW	438	198	101	290	87	28	121	175	125	317
Wagga Wagga NSW	540	249	118	367	116	34	156	199	146	256
Swan Hill Vic	333	206	66	227	70	24	96	104	99	206
Bendigo Vic	540	351	99	434	115	21	178	286	145	349
Horsham Vic	384	256	77	286	79	10	136	146	113	160
Lake Bolac Vic	565	201	122	303	106	7	164	218	156	223
Murray Bridge SA	364	112	61	132	73	54	126	120	102	191
Kadina SA	340	100	53	116	73	56	120	97	92	154
Cummins SA	391	71	48	108	83	6	176	210	83	137
Esperance WA	613	64	75	79	144	3	254	248	138	74
Wagin WA	400	106	43	115	96	0	179	119	83	29
Northam WA	405	35	42	67	88	1	194	122	79	31
Mingenew WA	368	62	31	85	92	0	184	145	61	6
Moora WA	398	0	45	0	92	0	191	139	70	29
Mullewa WA	323	193	40	304	96	0	139	152	44	6

Last rainfall reading March 11, 2011.

- Mouse numbers are reported to be increasing in several districts and will need to be monitored given current favourable conditions.
- The combination of exceptional yields and good prices should see most farmers get very good returns in 2010–11 despite the frustrations of rain affecting grain quality and prolonging harvest and grain delivery.
- Final estimates for season 2010–11 – total SA crop area of 4.02 million hectares with total crop production of 10.34 million tonnes. This is the largest crop ever produced in the state and exceeds the previous record crop in season 2001 by 10 per cent.

Pastures

- Paddock feed is generally prolific as a result of the summer rains with stock often not able to keep up with the rapid pasture growth. But the quality of dry feed, including that from stubbles, has deteriorated significantly with the ongoing rainfall.
- Annual legume pastures such as medics and sub clovers have germinated with some plants now at the four to five leaf stage. This poses the risk of a false break and subsequent loss of seed.
- Graziers have reported problems with sheep flystrike due to the warm, wet conditions over summer.
- There have been reports of stock losses in the Lower South East caused by grazing toxic weeds.

Peter Fulwood
Rural Solutions SA
March 10, 2011

VICTORIAN MALLEE

It is rare to see headers in paddocks in February (or March) in the Mallee, but this season it has almost been a matter of parking the header and pulling out the seeder. Harvest has been prolonged due to wet weather and in between harvest opportunities, many have been busy spraying the mass of summer weeds.

Of the 600 mm of rain received for Sea Lake last year, 385 mm fell from August. We received a further 200 mm in January and February. So in preparation for the 2011 cropping season, we have had 600 mm since the start of August.

This moisture is virtually untapped as soil moisture profiles are full almost everywhere.

Moving into the season, the challenge will be to capitalise on this moisture with adequate nutrition and disease management strategies. I have barely (if ever) seen a season in the Mallee where our yield potential hasn't been limited by moisture. Growers have been challenged with a diverse range of options coming into this season.

There will be many growing canola for the first time, and those who grew it last year will be likely to increase their acreage due to last season's success. Yields varied from 1.2 to 2.8 tonnes per hectare with good oil content.

Legumes also yielded well averaging around two tonnes per hectare. The cool finish really favoured all crops.

Variety selection has been limited by what seed was harvested before the rain. Availability of good seed is tight. Choosing varieties this year has required some thought with the threat of disease looming due to the green bridge over summer.

Sprouting tolerance has been a concern with memories of last harvest all too recent. Despite these headaches, grain prices were solid for the quality and yields were high – up to five tonnes per hectare in some of the better cereal crops.

One of the issues facing farmers now is how they will sow through the heavy stubbles or weed residue where it was inaccessible to spray. Some are fitting coulters to seeding equipment. Many will consider burning where appropriate, such as on heavy flat soils are less prone to wind erosion. There could be some weed control benefits associated with this where a hot burn can cook weed seeds. Mulching and prickle chaining will also be utilised as well as some discing where it is needed.

Sheep could even help, but for those who are out of sheep, it is costly to buy in. Heavy export lambs made $241 at Ouyen on February 17 and more recently, another record was broken in Swan Hill at $237.

The focus now is on getting the crop in and protecting it from would be predators. Mice are now active in the paddocks and have a favourable environment and feed source. Grasshoppers are present and we learnt last year that they can be unpredictable and detrimental.

There will be few paddocks uncropped this year as the goal is set to capitalise on a season of great potential.

Simon Severin
Dodgshun Medlin Ag Management, Swan Hill
March 7, 2011

MURRAY VALLEY RICE REPORT

The end of an interesting rice season is rapidly approaching. Crops are mostly looking good and the decision about when to drain them is exercising growers' minds at the time of writing this report.

It has been a different year. Crop water use has been incredibly low. Many growers have used less than 7 megalitres (Ml) per hectare of irrigation water for the season – about half of what they budgeted. I can't remember any previous year where irrigation water requirement have been this low. The main reason of course has been the unseasonably high rainfall with many crops receiving the equivalent of at least 4 Ml per hectare rainfall during the growing season.

The low irrigation water usage, coupled with lower than normal winter crop pre-watering demand, means most growers will have significant levels of carry-over. This almost guarantees next year's crop, at least in the Murray Valley, will be larger than the current one.

The current crop is looking reasonable and most growers expect yields to be close to average. This is a good result given some of the challenges of the season. Most crops were sown later than optimum, excessive rain meant that water was deeper than desirable during tillering and much of the top dressing at panicle initiation was late. (Top dressing delays were caused by trucks being tied up with a late winter crop harvest, wet air strips and crops maturing quicker than expected.)

The weather has been a significant challenge. The deep water during late tillering meant even deeper water was required at young microspore to give cold weather protection to the developing panicles. There were several cold nights at that critical growth stage and again at flowering. The other drawback was the substantial amount of cloud cover during the summer, causing solar radiation to be lower than average.

To top off the year, many crops have been invaded by mice. They initially penetrated well into the bays seeking early heads. As the crops matured, damage became concentrated in the outer 3–5 metres of each bay. Mice are good swimmers, and once they climb up to the panicle, they can readily move from plant to plant. Most growers in affected areas have baited banks several times. The fear is that once crops are drained, mice will move into the bays and baiting will become ineffective.

Mouse damage to an early rice panicle (February 11).

As indicated earlier, the challenge of timing crop drainage is currently facing growers. Most are opting to go slightly on the early side, risking haying-off sections of the crop. Their desire is to get the crop stripped as early as possible to minimise the chances of getting caught with a wet harvest.

John Fowler
Deniliquin District Agronomist, I&I NSW
March 7, 2011

WESTERN MURRAY VALLEY

Over the summer period most farmers have been either chasing fly blown sheep or spraying summer weeds! But there are few complaints with plenty of sub-soil moisture.

On average the Western Murray Valley has received 200 mm. This has resulted in plenty of summer weeds and an abundance of dryland lucerne. The positive out of all this rain is we haven't had to feed sheep or cattle for five months, and growers are starting the 2011 cropping season with plenty of confidence.

Summer weed control has been quite successful with a lot of paddocks potentially facing issues with large weeds that were growing prior to even a header going into the paddock. Hogweed, prickly lettuce, sowthislte, peppercress, heliotrope and melons have been the prominent weeds.

One weed in particular – flaxleaf fleabane which is of great concern in the northern region – has really only become obvious throughout the district this year. This weed is very difficult to control with herbicides and can become very invasive in our direct drilling–minimal tillage systems. This is a district wide problem that must be dealt with, particularly with the continued summer rainfall years.

Rice crops are currently being drained in preparation for harvest depending on the varietal maturity and sowing date. Paddocks of two short season varieties, Quest and YRM 69, are being drained now with another 7–14 days for the longer maturity varieties. With all this rain some rice farmers are nervous about late drainage of irrigation bays as it may stay wet and make harvest very difficult.

Rice harvest is planned to start late March and continue until mid April.

With a 100 per cent water allocation and high livestock prices many irrigation paddocks are being sown down to short term annual pastures of Italian ryegrass (Crusader/Hulk) and either sub clovers or Persian clover (Shaftal). Many of these old pastures have been run down without water over the past seven years, so little clover seedbank remains and fertility has dropped. Growers are also wary of barley grass and capeweed dominating without good control over past years.

Currently growers are eagerly getting the cropping plans for 2011 organised with a greater emphasis on canola and wheat.

There is little hay on the agenda as most sheds are full and overflowing from last year and it is very hard to sell. The only hay exception is lucerne, vetch and clover hay which is very high protein and digestible and can be used in dairy feed rations.

Stubble management after harvest is a real issue, with many headers leaving either very tall stubbles, or not spreading chaff well enough to allow direct drilling equipment to sow through.

Currently growers are trying everything they can to keep stubbles as it has been a vital part of the success to direct drilling. But if it means not sowing a crop in 2011 we are willing to remove it. The options being trialled so far are:

- Burning if it's not too wet;
- Offset discs;
- Using a Lely multi-disc (two passes);
- Kelly disc chaining (two passes); and,
- Mulching (slow and costly).

All of these practices seem to be working, however depending on autumn rainfall, some of the stubble incorporation may become an issue.

With autumn upon us and sowing just around the corner, controlling weeds and managing stubbles prior to sowing is a must. There are many options, all have positives and negatives.

The priority is 'preparation' and we just need to get ready to sow: to quote the great Hawthorn football coach Allan Jeans "DON'T THINK – DO!".

All the best for the beginning of 2011.

Laurence Pearce
Agronomist, IK Caldwell, Deniliquin NSW
March 12, 2011

SOUTHERN NSW

It's been a mild wet summer in south western NSW and now the first significant rainfall front this autumn has delivered between 30–80 mm.

Growers have taken advantage of the previous two weeks to get across paddocks that have up until now been too wet to spray.

Many autumn weeds are starting to emerge in stubble paddocks and it has been a good opportunity to control both summer weeds and the first flush of winter grasses and broadleaf weeds.

Excellent clover germination has occurred in many pasture paddocks and feed supply for livestock is generally not an issue as sheep producers commence their autumn lambing. With the mild wet weather there has been an increased incidence of livestock issues such as Barbers Pole, redgut and pulpy kidney.

Growers are grading and cleaning seed for planting and we have been receiving many seed samples for germination and vigour testing. Many have come back with 80–90 per cent germination, but a small number of samples have come back below standard and are not suitable for planting. But even with good lab germination results we are still encouraging growers to conduct further vigour trials on-farm, closer to planting, by placing seed in a tub of cooled soil to better emulate conditions at time of planting.

A mounting challenge approaching planting this season is stubble management. Many paddocks have excessive stubble loads that will create problems with crop establishment and seeder blockages. Wet conditions have reduced the capacity to utilise stubble mulching/conditioning equipment. At this stage it looks like a number of paddocks will be burnt prior to sowing.

Soil testing has indicated that we are starting to consume soil

Comparison of wheat seed emergence from two different seed sources. A small number of wheat seed samples tested by Delta Agribusiness have been below standard and are not suitable for planting. (PHOTO: Heidi Gooden)

phosphorus and soil tests are also indicating low nitrate levels. With good profile moisture at present – and a positive seasonal outlook – planting inputs are set to increase to capitalise early on good cropping opportunities. Given crop removal last season and leaching from summer rains, growers may consider nitrogen applications at planting where required.

With currently available soil moisture there is expected to be good opportunities for early sown crops. Canola is expected to increase in area and growers are considering putting some paddocks to early wheat varieties like Wedgetail, Bolac and Sunvale.

Season 2011 is looking very promising.

Warwick Nightingale
Agronomist/Consultant, Delta Agribusiness Lockhart
March 11, 2011

Northern region

LIVERPOOL PLAINS

As I write this, and as for many regions of northern NSW, rainfall has shut off since the first week of January. Many areas have received less than 20 mm of rain for January, February and early March.

Sorghum harvest has started earlier than normal. This has been forced upon us by lower moisture holding capacity soils, as well as warmer than usual temperatures and a lack of the wet stuff from the heavens.

Yields of early planted sorghum have been solid at 5.0 to 6.5 tonnes per hectare which is pleasing given the finish it has experienced. The rest of the crop – due to difficult planting conditions in December and early January – is spread out from almost finished to still waiting for heads to emerge.

By early March, late planted sunflower crops on the Liverpool Plains were travelling pretty well but would certainly benefit from a timely shower.

Midge is beginning to be a problem in flowering sorghum and control measures are required in some paddocks.

Early planted sunflowers are being harvested now with some pleasing results. Yields have been around the 2.0 to 2.5 tonnes per hectare mark, although it is too early to establish any oil results at this stage.

Late planted sunflowers are flowering now and would benefit greatly from a splash of rain but they seem to be hanging on better than the late planted sorghum.

Mixed bag of cotton

Cotton in the region is a mixed bag with some solid planted dryland crops cutting out by mid February with the remainder cutting out by the end of that month.

On the southern end of the Plains there is still a question mark over the best planting configuration although the final answer won't be known until some real ground truthing is provided with the ginning results.

Irrigated cotton looks good and the drier, warmer conditions have suited the crop. Defoliation will begin around early to mid April.

Winter crop decisions are still up in the air as there is still a bad taste of a wet harvest in growers' mouths from last season. But the decisions will generally be based on rotation requirements and setting paddocks up for the next summer crop.

Some dry seeding of winter forage crops has occurred, although the vast majority hasn't been put in the ground. Seed is in short supply which makes growers cautious about taking a punt.

Here's to a successful and prosperous 2011.

Peter McKenzie
Agronomist, AgVance Farming P/L
March 11, 2011

NORTH WEST SLOPES & PLAINS

In what has been a tumultuous 2010–11 summer season so far there have been mixed results for growers in the North West.

In the northern parts of our region there were devastating effects of the floods on crops and infrastructure around Texas, Boggabilla, Goondiwindi and downstream to Mungindi and Collarenebri. Some farms have been inundated four times since October. Many of these growers lost most or all of their winter crops and have now also lost one or two summer crop plantings.

But the resilience and resolve of these growers is amazing and whilst being a difficult period in their lives, it has been inspiring and rewarding to be able to work with them through this time.

For those growers who have managed to stay out of the flood waters, this season has been a positive one.

Although the area planted to sorghum was well down on the

normal planted area due to a swing to dryland cotton, those who planted early sorghum were rewarded with good yields ranging from 3.0 to 6.5 tonnes per hectare and reasonably light insect pressure. As the late crop moves into grain fill now it would be great to see some rain to help these crops finish off. But late croppers are likely to get a good result anyway if harvest weather is kind to them.

Mungbean plantings were down a little this summer again due to country going to dryland cotton, but most who grew them were rewarded with good yields (1.3–2.5 tonnes per hectare) and quality. Insect pressure (helicoverpa and mirids) was high in the early crop with many growers being forced to spray three to four times. Western crops were also impacted by spur throated locust and grasshoppers.

Sunflowers were a good early option this summer for those who were out of the path of the floods. A number of crops were lost to flooding and water logging. For those that were out of the water, yields were good ranging from 1.5–2.0 tonnes per hectare and insect pressure and disease were low.

Fallow conditions at this stage are encouraging with many fallows holding good moisture heading into this winter season.

The increased plantings of dryland cotton this season, combined with wet fallows and untraffickable country, has resulted in fleabane control being a real struggle with continuous germinations throughout the summer. This, combined with some water damaged country, has resulted in a fair area previously no-tilled, cultivated this season.

Good rainfall prior to planting will be needed to get these areas wet enough to plant.

Tim Burley
District Agronomist
Industry and Investment NSW, Moree
March 9, 2011

DARLING DOWNS

Summer crops

Harvest of the early grain crops is well underway, with the few showery days not causing any damage to crops. Early yields have been good with sorghum ranging between five and 10 tonnes per hectare with good quality. Over the whole Downs about 40 per cent of the crop is harvested. The later sown crops are ripening now but will generally be lower yields with many crops suffering some pollination damage from earlier rain.

The cotton is moving into the open boll stage, but is a mixed bag. Undamaged dryland crops are about one month off defoliation, and crops that have drained well are heading towards an average or above average yield. But crops damaged by waterlogging will have low yields, and are running very late and looking at a late May defoliation.

There was a reasonable area of late crop planted in mid to late January into failed winter crop ground, mainly being maize and mungbeans. The early February rain filled-in establishment gaps and the recent 50–90 mm has given these crops a fair potential as they pod up. Spring planted mungbeans have yielded between 0.5 and 1.2 tonnes per hectare, with some crops suffering heavy weather damage.

Insect pressure has varied through the season, with sucking pests being the main problem, especially aphids, mirids, mites and green vege bugs, whilst heliothis have been average to quiet. Fungal diseases are now appearing in mungbeans but early fungicide control appears effective.

Weed control has been difficult, both from wet ground limiting spraying opportunities and growers foregoing spraying to avoid damaging neighbouring crops – especially vegetables and cotton. Weed germination has been aided by the wet conditions, and although there have been some good results on the range of harder to kill weeds, the lack of opportunities for control has seen plenty of fleabane and feather top Rhodes grass escape this summer.

Horticulture

The Lockyer Valley area can be divided into two parts – those with topsoil and those who lost theirs with the floods. Farms without topsoil are struggling and many growers are trying winter forage crops to replace organic matter, and manure where it is available. Some of these growers have leased ground over the range to grow their crops, especially direct seeded, rather than transplanted crops.

Growers with topsoil are planting lettuce, broccoli and brassicas, and the cooler temperatures are assisting after a hot start. Crops are more advanced over the range with the Cambooya area well ahead. Late pumpkin crops are being harvested but yield and quality have been affected by bacterial diseases and storm rain.

Winter production is expected to be about 70 per cent of the usual capacity, due to the ongoing recovery from the flood damage – but this varies from grower to grower.

Further west at Chinchilla melons have suffered some losses but picking is expected to start in April.

Winter outlook

Recent rain between 50–90 mm with odd falls up to 200 mm have lead to good levels of stored moisture. The predicted fair to strong prices give growers some optimism for the winter crop.

The memories of the past season and the crop losses caused by disease are forcing growers to re-evaluate their rotations and disease mitigation measures, and to more rigorously plan their crop choice, seed treatment, planting time, row spacing, population and control measures.

At this early stage, oats is the only crop being planted, with strong demand for seed for early sown grazing and hay crops.

Hugh Reardon-Smith
Agronomist, Landmark Pittsworth
March 10, 2011

WESTERN DOWNS & MARANOA

Summer crop

The summer crop has been a pleasant surprise for most after what was an extremely trying winter crop harvest. Early season sorghum is being harvested at the moment and is yielding quite well for the region (over 6 tonnes per hectare in areas). Most crops were able to capitalise on the wet spring and summer with good rains falling prior to flowering.

Mungbeans and sunflowers in the region are also performing quite well.

With so much winter crop downgraded or deserted, growers have also opted to plant some late season summer crops, mainly sorghum with some mungbeans as well.

Recent rains have improved these crops dramatically as some crops had not seen good rains since planting.

Key issues

Mice, mice and more mice! The wet weather and abundance of food has caused a rapid rise in mouse numbers in the region. You just have to look down the road at night to see scurrying little rodents everywhere and trap and bait sales would be through the roof!

Most of the early season summer crop has escaped relatively unscathed but the same can not be said for the late season crops. Large areas of crop have had to be replanted. Many growers have baited their crops with varied success as the mice in the crop are destroyed – but more mice are moving in from untreated pasture paddocks or headlands.

Some of the early season summer crops have also suffered damage from spur-throated locusts late in the season. This damage ranged from light defoliation through to grain damage. Growers have managed to rein the locusts in with a well timed insecticide application in an effort to stop further damage and minimise the chance of seeing another wave later in the year.

Looking forward

Chickpea growers should be prepared to face a challenging season and take appropriate actions such as sourcing clean treated seed, considering wider row spacing and making timely fungicide applications. While some growers are talking about not planting chickpeas this season, most are aiming to grow a reduced area and monitor the crop quite closely for pests and diseases.

Wheat is still the major winter crop and most growers are optimistic about the coming season particularly with the good moisture profiles.

Some area has been cultivated to level paddocks, control problem weeds, apply nitrogen and potentially reduce mouse numbers.

Oats are just starting to go in the ground and everyone is wishing for a few decks of cheap cattle to fatten! As with all winter crops, growers will need to monitor mouse numbers and consider baiting both the planted paddock and the bordering area in an effort to protect the crop.

As always, the goal is to have a better season than the one before, so I hope we can make that goal a reality!

Dale Kirby
Extension Agronomist – Sustainable Farming Systems
DEEDI, Roma
March 9, 2011

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

It is one of only a handful of Orenstein and Koppel S32 K tractors remaining in the world. It was manufactured in Berlin in the late 1940s and featured a thumping big V2 diesel engine. Restored by IMJ.

SOUTH BURNETT

Key Issues

- Extremely wet followed by dry weather;
- Most crops recovered reasonably well from waterlogging; and,
- Late plant of beans and corn.

The extreme wet conditions of December and early January eased off with reasonable falls in late January. The next widespread rain was in early March. Most crops by then were looking for another drink. Good general rain of 40 to 90 mm across most of the district were welcome to preserve yield potential.

The area planted to peanuts was less than 50 per cent of a usual planting. Weed control has been a problem with the wet weather so many crops look untidy. Net blotch from the continued early wet weather has meant early fungicide applications. Given the season, crop potential is reasonable.

We had a small sorghum plant. Even early crops have ergot as they flowered in the wet weather.

Significant areas of late corn were planted in late January and early February. Hope we don't get an early frost. Most is processing corn such as P55.

We have crops of late late mungbeans. These will need a lot of luck to get through. Powdery mildew in Crystal is already showing up. Just as well there is a permit for tebuconazole.

Growers are still repairing flood damaged soils and infrastructure.

Only about 250 hectares of cotton has survived the floods out of 1200 hectares.

Most growers are hoping that the summer of 2010–11 just disappears and is soon a distant memory.

Ian Crosthwaite
BGA AgriServices, Kingaroy
March 8, 2011

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