



Australian Government

Grains Research and
Development Corporation

Making the most of a wet summer in the Southern Region



A crop planning guide for 2011

*Driving national collaborative grains research, development
and delivery for grower profitability and sustainability*

GRDC

Grains
Research &
Development
Corporation

Edited and compiled by:

Graeme Jennings – *Jon Lamb Communications*

Ph: (08) 8362 5417 Fax: (08) 8363 1052

Design and Layout:

Peter Hoffmann – *Lightning Designs*

Disclaimer – GRDC

This publication has been prepared in good faith on the basis of information available at the date of publication.

The Grains Research and Development Corporation does not guarantee or warrant the accuracy, reliability, completeness or currency of the information in this publication nor its usefulness in achieving any purpose.

Readers are responsible for assessing the relevance and accuracy of the content of this publication. The Grains Research and Development Corporation will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication.

Products may be identified by proprietary or trade names to help readers identify particular types of products but this is not, and is not intended to be, an endorsement or recommendation of any product or manufacturer referred to. Other products may perform as well or better than those specifically referred to.

Caution: research on unregistered pesticide use

Any research with unregistered pesticides or of unregistered products reported in this document does not constitute a recommendation for that particular use by the authors or the authors' organisations. All pesticide applications must accord with the currently registered label for that particular pesticide, crop, pest and region.

Re-use of information

Information in this book may be used provided the author(s) and the Grains Research and Development Corporation (where it is a contributor) are acknowledged.

ISBN 978-1-921779-24-4

Published March 2011

© Grains Research & Development Corporation

Cover: Main photo: Paul Jones



Meeting the challenges, grasping the opportunities

A GRDC crop management planning guide for 2011

After one of the wettest summers on record, the 2011 season is one of potential and challenge. There is huge scope in the available moisture stored in the soil provided the right approaches are taken to issues such as crop nutrition, seeding systems and crop management.

The biggest management challenges include:

- stubble management
- weed management
- nutritional issues
- pest and disease management

All these issues need to be resolved within the financial realities of each farm business and this publication, initiated by the GRDC Southern Panel, is designed to help growers take full advantage of the soil moisture in their cropping systems as a result of the recent La Nina conditions.

'Making the most of a wet summer in the Southern Region' brings together available knowledge on issues facing growers in the coming season and provides a reference framework for decision-making in the current production environment.

The following guidelines contain information designed to help growers identify strategies that will suit their conditions and assist them in obtaining the greatest long-term benefits from the available moisture in the 2011 season. Growers should seek expert local advice before taking any action.

GRDC would like to acknowledge and thank the researchers, agronomic and financial advisers and growers who contributed to this document by providing information or acting as referees. They include Allan Mayfield, Nigel Wilhelm, Rob Sonogan, Hugh Wallwork, Alan McKay, James Hunt, Jack Desbiolles, Chris Preston, Phil O'Callaghan, Jon Midwood, Bill Long, Neil Fettell, Stuart McColl, Rob Norton, Stuart Kearns and their associates and co-contributors.

David Shannon – Chair, GRDC Southern Panel

An outline for seasonal decision making

Step 1. *Work with your accountant and/or financial adviser to establish the true financial health of your business. Once this has been determined work through the following sequence*

Step 2. *Review personal (family) needs and expectations*

Step 3. *Review the farm enterprise:*

- prioritise capital needs against other expenditure needs
- work out what you can afford to spend on the cropping program. If finances are limited, consider focusing the available resources on the best soils.
- work with your agronomist to ensure you consider all the issues and options

Step 4. *Review paddock condition:*

- identify and address any soil damage or access problems likely to impact on 2011 crops
- develop and action a weed management program for:
 - weeds ahead of seeding
 - weeds at seeding
- assess the risk of pests such as mice or slugs and address the threat if necessary
- assess stubble loads by paddock ahead of seeding
- work through sowing-time issues and options with your agronomist

Step 5. *Measure or test to accurately establish the moisture and nutrient status of each paddock or management zone. Use this information to plan the cropping program taking account of:*

- rotation issues [disease, weed, pest and nutrition factors]
- fertiliser requirements and what you can afford to spend

- disease threats and potential fungicide needs
- WUE impacts of seeding time/variety interactions
- potential demand and prices

Work with your agronomist to ensure all the options are covered and that long and short-term issues are addressed.

Be prepared to change inputs or crop types depending on soil test results and seeding conditions.

Step 6. *Address seeding-time issues including:*

- seed quality. Have seed tested to ensure germination percentage and vigour are adequate.
 - if quality is not adequate, source other seed
 - adjust the seeding rate if seed quality is less than ideal
- trash clearance and seeding accuracy
- placement of seed and fertiliser
- efficacy of soil-activated post-emergence herbicides

Step 7. *Once crops are up, monitor frequently and regularly for:*

- pests
- disease
- nutritional deficiencies

If a problem is identified and action required, act swiftly and decisively.

Step 8. *Develop a cash-flow budget that includes the above costs plus the overhead, financing and personal costs necessary for the business to operate through 2011-12 and provision for a financial buffer to cover future tax liabilities. If funds are available, target debt of around 10% of total debt. Use surpluses wisely.*

Establish the priorities

Decision issues

- *Keep sight of the basic principles*
- *Research and measure to establish the facts*
- *Seek expert advice*
- *Make informed decisions*
- *Act decisively*
- *Establish the priorities*

Given that many districts have not had high soil moisture levels ahead of seeding for a decade, the current production environment is unfamiliar to many farmers.

Despite this, the basic principles have not changed. Crops still need adequate nutrition, timing is still important, weeds, pests and diseases need to be controlled and costs contained.

Good management is good management, whether conditions are wet or dry. Making good decisions based on measurement and well-researched facts and doing the basic things well will help ensure the best possible outcomes.

Deciding where to start is the first step. The top priority is to ensure paddocks are ready to be seeded on time and anything likely to prevent that needs to be at the top of the list.

Determining priorities will help managers:

- identify the decisions they need to make
- develop a strategy
- identify long and short-term objectives

- identify long and short-term risks
- identify costs and benefits to ensure they are not 'throwing the baby out with the bath water'
- plan the work needed to make the most of the available moisture

Informed, realistic, objective decision-making based on the best information available is needed. This is likely to involve resolving conflict between what is most important – possibly in the longer term – and what needs to be done immediately.

Identifying and prioritising the issues also has the potential to help growers identify the best solutions to particular problems.

Base decisions on solid data. It is important to test and measure rather than guess a paddock's nutrient status and moisture level. Measure moisture levels and moisture depth to establish how much moisture is available.

If good decision-making processes lead to a decision to cultivate to address soil damage or burn to deal with high stubble burdens, have the confidence to act on that decision without feeling guilty.

Make every decision pay

Financial issues

- **Know your true financial situation**
- **Determine priorities and make fact-based decisions**
- **Establish a reserve**
- **Re-evaluate the farming system**
- **Consider re-building soil fertility**
- **Provide for future tax payments**
- **Use any surplus wisely**

Good decisions are the key to effective risk management and the starting point for such decisions is accurate information.

Have a clear picture of the true financial position of the farm business, not just the cash flow when making management decisions.

For businesses with cash in the bank and moisture in the soil, now may be the time to take a little risk and explore some of the cropping and management options that you have considered in the past. However, it is very important to plan and control the use of the profit made in 2010 and make sound expenditure decisions.

For those still under financial pressure, the message remains the same:

- establish a clear and accurate view of your business situation
- consult with your advisers, including financiers, and
- make the best possible use of the resources available - use input and management resources on the best soils to maximise return from each dollar invested.

It is prudent, even when conditions are good, to set aside some money as a reserve and keep a close watch on costs. This is particularly important in the current situation, where most districts are experiencing one good year after a run of poor to bad years.

Options for cash available for expenditure could include catching up on 'personal care' issues by meeting valid personal needs and wants, which have been relegated to a low priority during the recent low-income drought years.

From a farming perspective it represents an opportunity to:

- re-establish soil fertility levels
- re-evaluate the farming system by making sure everything is in place and as good as it can be
- re-establish rotations (including new 'break crop' options such as pulses or canola).

When assessing the pros and cons of rotation options, factor in the financial elements including income spread and diversity. Take account of the longer-term flow-on agronomic benefits such as disease break and nitrogen contribution that can extend over several years.

Other business options for use of surplus cash include:

- machinery upgrades
- putting a financial buffer in place
- reducing debt and tax management

Decisions about where to spend depend on the financial position of the business. Expenditure should be limited to areas where there is a genuine need, particularly when considering high-cost purchases such as new machinery.

Many growers will have significant carry-forward losses to balance last season's income; which presents an opportunity to reduce debt at low tax rates. However, do not lose sight of the tax implications of 2010-11 income levels and retain reserves sufficient to meet future larger tax payments.

In the paddock, growers are facing increased input costs due to higher fuel and fertiliser prices. The size of last year's crops and the soil moisture available mean higher fertiliser rates will be needed in the coming season. Input costs are likely to be at least 15% higher this season, which will increase financial risk exposure.

If additional machinery passes or other procedures are needed to set paddocks up for seeding, additional costs will be incurred.

The risk embodied in these increased costs is balanced by the good incomes from 2010 crops in most districts. The exception may be in high-rainfall areas where there was extensive waterlogging, flooding and wet harvest conditions.

Growers with increased income from last season will be able to apply more phosphorus – and trace elements if needed - to start rebuilding fertility reserves after an extended period of lower inputs. This increased expenditure will increase the financial risk, which will compound the seasonal risks involved in producing a crop and generating an income.

The good soil moisture in many districts is balanced by the risks – and agronomic challenges - posed by factors such as the 'green bridge' of volunteers and weeds. These have the potential to use up valuable moisture and nutrients and significantly increase the carry-over of diseases and insects and the risk of early infection and infestation of the coming season's crops.

Paddock and soil conditions

Soil issues

- *Prepare for seeding by repairing paddock damage*
- *Act early to allow maximum time for stabilisation*
- *Monitor this year's crops for the effects of compaction and review the implications of operating machinery on cropping soils*
- *Calculate the timeliness and other costs of inability to access wet paddocks and review systems and processes*

Access to paddocks was a major challenge for much of the past season.

During the growing season, wet conditions that made it difficult to get machinery into paddocks prevented or limited the application of fungicides, herbicides and nutrients. This contributed to high crop losses in this year's wet, high-humidity conditions, particularly in pulse crops under disease pressure.

At harvest time, the combination of wet soils and the drive to get the crop off resulted in bogged machinery and extensive soil damage. Many growers are now facing the challenge of farming soils damaged by harvest machinery.

Some of that damage - holes and ruts where machinery was bogged then pulled or dug out - is obvious. Ruts resulting from 'normal' movements by headers, tractor bins and trucks are less problematic but will still pose a challenge for accurate seed placement come seeding time. However, these also indicate the soil has been compacted.

Compaction occurs whenever machinery is driven over a paddock but the effect is worse when the soil is wet. Compaction reduces fertility by decreasing the soil's ability to take in and store moisture and nutrients. The result is reduced plant growth, lower amounts of fresh organic matter returned to the soil and subsequent reductions in biological activity and nutrient recycling. Compacted soils also contain less air and are harder for plant roots to penetrate.

Conversely, the lack of pore space due to compaction can also increase waterlogging.

Soil compaction can reduce crop yields by 10 to 15% in Australian dryland conditions and that does not take account of the access problems impacting upon the timing of seeding, sprays or harvest.

The current circumstances present two challenges:

- how to prepare damaged paddocks for seeding in a few weeks time
- how to address the compaction and avoid it happening again

The immediate challenge is 'rut repair' to get the paddock surface smooth enough for seeding. This is likely to involve cultivation to break up ridges and fill ruts. In some

paddocks it may be possible to cultivate only particularly rough areas, leaving shallow ruts in other parts of the paddock to repair naturally. Do this as soon as conditions are dry enough to ensure the maximum possible time for disturbed areas to stabilise and 'settle down' so the natural processes for dealing with compaction can begin.

Good establishment of the 2011 crop is the over-riding consideration and there is a case for cultivating the entire paddock to ensure conditions are as uniform as possible at seeding.

There are few short-term solutions to sub-surface soil compaction apart from deep ripping, which is unlikely to be a practical option in most southern Australian conditions. Deep ripping when soil is too wet can do more damage and make the situation worse.

Anyone considering deep ripping should seek expert advice on the best approach and timing, including the machinery best suited to the conditions and most likely to produce the desired results.

Soils that crack as they swell and shrink in response to changes in moisture levels will eventually self-repair, provided they are not re-compacted by more traffic. Compaction in duplex and sandy soils is more problematic.

Crops with strong, deep root systems may penetrate compacted layers and help open up soils and provide 'channels' for the roots of subsequent crops to follow. Crops with this type of root system include lupins and lucerne.

The cure for compaction is to avoid it and the way to achieve this is through controlled traffic farming with all equipment, including the header and all harvest equipment, confined to permanent wheel tracks. This eliminates machinery compaction of cropping soil and establishes wheel tracks that maximise the chance of getting machinery into paddocks whenever necessary to spray, spread fertiliser or harvest. Fuel consumption is also reduced due to improved traction on the hard permanent wheel tracks.

With true controlled traffic the cropping soil is reserved for crops and managed for maximum yield and the wheel tracks are reserved for the wheels of farm machinery.



Don't skimp on weed control

Weed issues

- *Summer weeds use moisture and nutrients*
- *A 'green bridge' of volunteers and weeds increases pest and disease risks*
- *Summer weed control pays high dividends – more than 300%*
- *Multiple sprays may be needed for effective summer weed control*
- *Don't skimp on rates*
- *Consider a 'double knock' combination immediately prior to seeding*

Don't lose sight of the importance of weed control. Summer weeds use valuable moisture and nitrogen (N) and other nutrients that become unavailable to crops in the short term. If left uncontrolled they will also increase the amount of surface trash, complicate seeding and set seed that may increase summer weed issues in future seasons.

Weeds in most districts have ample moisture this season and so will not be moisture stressed, opening the way for more effective herbicide control, assuming the right products are applied using the right nozzles and at adequate rates. All three elements – the most effective chemical, good application technology and using label rates – are critical to success.

Control is best and most economical when weeds are small. This season two or even three summer sprays have been applied to achieve the necessary levels of summer weed control in some districts. CSIRO studies estimate an average return on money invested in summer weed control in southern Australia at 353% - \$3.53 for every \$1 invested - with very little risk for that return.

The prolonged harvest and paddock access problems due to saturated soil this summer have seen many growers faced with large weeds. Use the full label rate for the weeds present in the paddock and ensure excellent coverage and maximum efficacy. This may require high rates of chemicals, so it is important to follow label directions and spray only when conditions are right. This

will maximise efficacy and minimise the risk of off-target damage to sensitive crops such as grape vines.

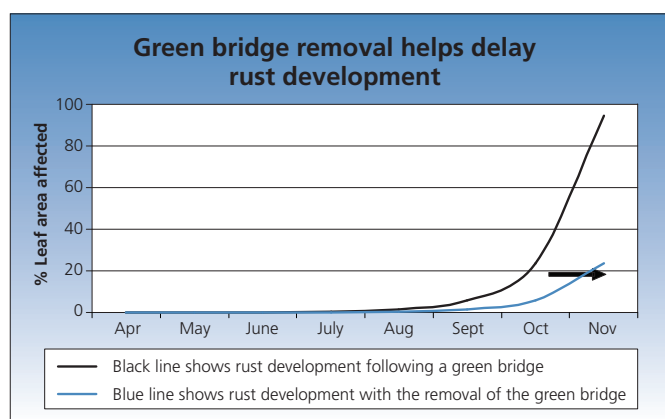
Good soil moisture levels, if maintained in the topsoil until seeding, will ensure growers achieve a good weed kill immediately ahead of seeding. This will be significant in a season in which the efficacy of soil-activated post-emergence herbicides is likely to be challenged by the amount of organic matter on the surface of cereal paddocks in particular.

Given this and the larger weed seed banks, this could be the year for a double knockdown program – full-rate glyphosate followed by full-rate paraquat five days later – to take out as many weeds as possible and minimise weed competition during the establishment phase.

With the large seed set of weeds, especially grasses, in crops last year it is important to do everything possible to maximise the efficacy of soil residual herbicides to control grass weeds germinating in crops during the growing season. The likelihood of straw and other organic matter remaining on the paddock surface at seeding means close attention must be paid to rates and coverage when using chemicals such as trifluralin, prosulfocarb and metalochlor.

Trifluralin in particular is bound closely to stubble residue, so higher rates are needed where there is a lot of surface trash. Boxer Gold® is less susceptible to stubble tie up than trifluralin but will not be effective if it cannot reach the soil. The efficacy of Boxer Gold® will be reduced where more than 50% of the paddock surface is covered by stubble. Use of large droplets will help maximise efficacy when spraying in high-stubble conditions.

The moisture in the environment and the large amount of grain left in paddocks mean there will be unusually large amounts of volunteer cereals present ahead of seeding.



Source: Grant Hollaway, Vic. DPI

This 'green bridge' has the potential to host pests and diseases, allowing 'out of season' population build-ups that may lead to early infections or infestations that can trigger epidemics of insects and diseases as crops develop. There is a strong case for a knockdown with paraquat or glyphosate six weeks ahead of seeding followed by a double knock in the week prior to seeding.

With dry conditions ahead of seeding unlikely, the 'green bridge' poses a large and significant threat. Money spent on effective weed control ahead of seeding will minimise in-crop problems and be more cost effective. Widespread rust infection, for example, increases the likelihood of mutations occurring in the rust population. This places resistance genes in crop varieties under greater pressure and could lead to them breaking down. Higher rust populations also place greater pressure on chemical controls.

Pests and diseases that benefit from a 'green bridge' include:

- stripe, stem and leaf rust
- viruses including wheat streak mosaic, barley yellow dwarf, beet western yellow, bean leaf roll, powdery mildew, rhizoctonia
- diamond-back moth
- aphid species

The risk of early-season attack from these pests and diseases can be minimised by eliminating all summer and autumn weeds. The ideal is early control, which maximises moisture and nutrient benefits as well as breaking the 'green bridge' and minimises spray costs.

Disruption of the 'green bridge' mechanism requires removal of all green vegetation far enough ahead of seeding so pests and diseases die before they can move onto seedling crops. To achieve this all weeds on the property and adjoining areas need to be sprayed out at least six weeks ahead of seeding.

Evaporative losses from fallows are restricted to the top 20 to 30 cm of soil but summer weeds are able to extract water from much deeper in the profile. Some research suggests water deeper in the profile has greater value because it is often accessed later in the season when crops need moisture to fill grain.

A national study by researchers at the former Weeds CRC found that:

- the larger the summer weed biomass the more water and nutrients were removed, resulting in lower subsequent crop yield and grain protein
- summer weed biomass of around 3 t/ha dry matter reduced wheat yield by up to 40% (1 t/ha in a 2.5 t/ha crop) and grain protein by an average of three to 5%
- N and other nutrients are tied up in summer weed biomass and become unavailable until it breaks down and the nutrients are released back into the soil

If money or time is limited, focus on controlling weeds on soils with the highest soil moisture content and yield potential such as long fallows or pulse stubbles. This will provide the greatest return on investment in summer weed control.

Stubble issues

- *Explore all the options and be flexible*
- *Burning is only one stubble management option*
- *Other options include slashing or using the header to reduce stubble length and spread residue*
- *Look at the whole picture including longer-term nutrient implications*
- *Stubble on or in the soil breaks down faster than standing stubble*
- *There is no need to remove all surface cover*
- *Trash 'flow' can be improved by good machine set-up and simple 'smoothing' devices*
- *Inter-row seeding and 'residue managers' can improve trash flow*

Stubble - threat and potential

Hheavy stubbles in most paddocks this season hold huge potential as a source of organic matter, with flow-on benefits including improved soil structure, water infiltration and soil health.

However, high stubble loads present as surface trash at seeding time have the potential to disrupt seeding and impact on crop establishment. Large volumes of surface trash will also reduce the efficacy of soil-activated pre-emergence herbicides. The management of large residues also has nutrition implications because nitrogen is required for cereal stubble breakdown.

The volume of surface residues in many paddocks and the time available for stubble management may mean some growers will decide to burn. There may be better long-term options but burning is a quick, simple, cheap, and effective way of reducing surface trash. The degree of benefit will depend on the timing, temperature and thoroughness of the burn.

Burning stubble will:

- reduce residue volume
- kill some weed seeds
- lower the risk of stubble-borne diseases such as crown rot, eyespot and yellow leaf spot and reduce some pest problems, such as snails and mice

Negatives of burning stubble include:

- can have off-site impacts
- increasingly frowned upon by the community
- valuable carbon and other nutrients including nitrogen, phosphorus, potassium and sulphur literally go up in smoke. Approximately four kilograms of nitrogen are lost with every tonne of wheat stubble burnt.

Some nutrients within straw are lost to the atmosphere when a 'hot burn' is used to remove stubble but a 'one off' burn will have minimal direct adverse effect on the sustainability of a farming system.

For example, a grower who hot burns a 7.5 t/ha stubble (the residue of a 5 t/ha crop) would need to apply about 30 kg/ha of single super and 87 kg/ha of muriate of potash to replace lost nutrients.

Delaying burning until closer to seeding (when conditions are more likely to be cool and possibly even damp) can result in a 'cool' burn that will leave some residue to benefit the soil. A 'cool' burn will be less effective than a 'hot' burn in reducing weed seed loads and pests such as snails.

Other options for handling this season's high stubble burdens include:

- inter-row seeding

- mulching and spreading it evenly over the surface
- working it into the soil
- cutting and removing the straw for sale or for on-farm use

Mulching stubble, which involves breaking the straw into smaller pieces and laying it on the soil surface can:

- increase the rate of breakdown and reduce trash flow problems at seeding
- slow evaporation and improve water availability, particularly for crops sown on wider row spacings

Crops can be mulched using harrows, a prickle chain, a disc chain, a flail mulcher, a Stubble Cruncher or Trash Cutter.

Another quick and simple option is to drop the header comb to near ground level and use it to reduce the height of the standing stubble and spread the cut straw evenly across the paddock as chaff. Chaff on the paddock surface is easier to handle than stubble left as straw, will have less impact on soil-activated herbicides and cause less blockage problems at seeding.

The Stubble Cruncher knocks down and cuts stubble, reducing the length of the straw, and pressing it into the soil surface.

The Trash Cutter uses coulters to cut stubble into short pieces and spreads it evenly on the soil surface.

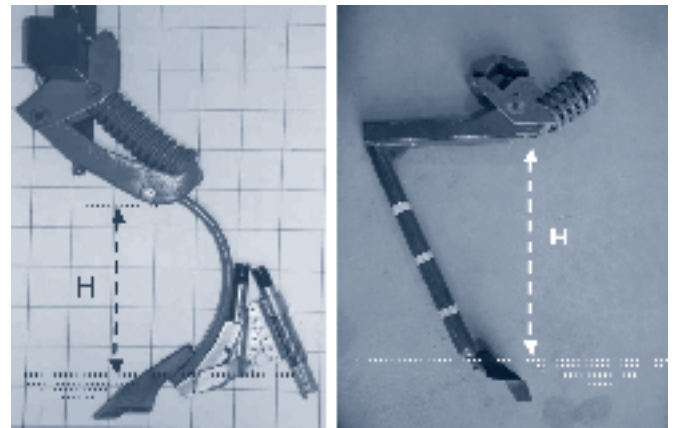
Many no-till tyne seeders can operate well in paddocks with more than 4 t/ha of stubble, given good conditions, but much seeding equipment is unable to handle more than 3 t/ha of cereal stubble, even with row spacing of 250 to 300 mm. This season many growers, even in traditionally low-rainfall districts, are estimated to have seven to 10 t/ha of stubble in their paddocks, so will need to reduce the amount of surface residue ahead of seeding.

Researchers from the University of South Australia have found that the residue-handling capability of no-till tyne seeders can be maximised by ensuring:

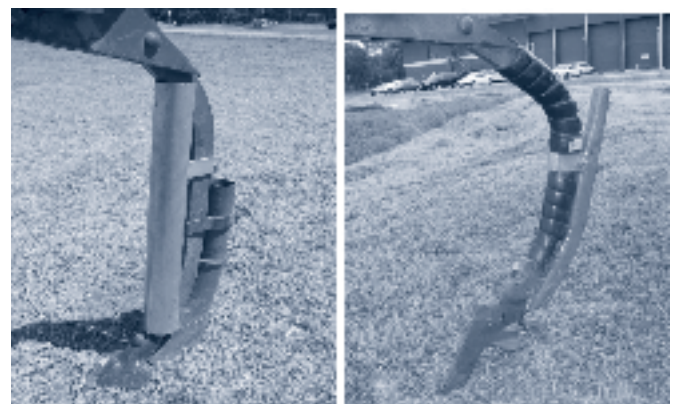
- distance from the soil surface to the first obstruction on the tyne shank is 1.5 times the stubble height or length
- there is at least 550 mm of clean tyne shank
- the shortest horizontal distance between any two tyne assemblies in any direction is 1.8 to two times stubble length
- straight tyne shanks with a smooth round cross section of 40 to 50 mm diameter
- tynes have a continuous profile or very gradual change in shape and are set so they are vertical or angled slightly backwards

Other observations include:

- Inter-tyne spacing needs to be greater when operating in standing stubble and at the rear of the seeder bar, where effective residue levels are greater due to aggregation of residue by the machine.
- Many tyne shank shapes differ from the optimum. This can be addressed by fitting residue deflectors or low-friction plastic wrappings.
- Seed boot brackets fitted onto shanks impair residue flow and promote greater clumping.
- Low speed and dry stubble significantly improve residue flow through tyne seeders.
- Inter-row sowing will significantly improve residue-handling capability and in the right conditions can virtually eliminate residue clumping.
- Widening row spacing will improve trash flow through seeding equipment.



Effective tyne vertical clearance (H) for commercial tyne (left) and preferred shank design for high residue handling capacity (right). The above rules of thumb were developed from trials conducted in stubble of up to 4-4.5t/ha.



Add-on residue deflector for edge-on tyne (left) and Pig's Tail™ wrapping to improve residue flow (right).

Source: Jack Desbiolles, Institute for Sustainable Systems and Technologies, UniSA, 'No-till seeding systems', 2011 Victorian GRDC Research Update

However, clumping can still occur even with well-set-up no-till seeders.

Grazing may lower the amount of organic matter but stock will trample stubble onto the surface, which is likely to worsen residue handling issues at seeding unless breakdown is fast enough to reduce the amount of surface trash present at seeding.

Disc seeders are better able to handle surface stubble than many tyne seeders, especially if sowing on the inter-row, but need to be set up and operated correctly, including at the right speed. Switching to a disc seeder purely as a means of dealing with this season's stubble load carries no guarantee of success.

It is estimated that 20 to 49% of harvest residue will be decomposed by seeding time the following season in average southern Australian conditions. In Queensland, where there is usually more summer rainfall, the stubble reduction between harvest and seeding is 57 to 84%. This suggests that, with the high moisture levels in many parts of the Southern Region this summer, there could be much less stubble present in many paddocks at seeding time than currently expected.

'the key is to be flexible, explore all the options'

Stubble lying on the soil surface breaks down more quickly than standing stubble and, provided moisture and temperature conditions are right and sufficient nitrogen is available, organic matter incorporated into the soil breaks down even faster than that on the surface.

Incorporation can increase erosion risk and moisture loss, but given the high stubble loads and the ruts in many paddocks, early cultivation to level paddocks and accelerate stubble breakdown may be a good option, even for committed no-till farmers.

Shallow incorporation of stubble into the top two or three centimetres of soil ahead of seeding is the best option for growers with big crop residues who want to retain their stubbles, according to Southern Farming Systems CEO, Jon Midwood. This is best done with specialised equipment with accurate depth-control mechanisms and rollers to stabilise the soil surface and maximise stubble/soil contact. However, given the current circumstances, working stubble into the soil with a disc plough several weeks ahead of seeding appears to be a practical option.

Growers who retain all or some of their stubble may gain some benefit from using a 'residue manager' to clear surface residues from ahead of tynes or coulters during the seeding operation.

University of South Australia researchers have found that row cleaners are best suited to wider row spacing and non-sticky conditions and operate best along stubble rows. They need to be used at optimal speed, which varies with the set up and conditions.

Stubble tubes - low-friction metal or plastic guards positioned in front of the tyne shanks to improve stubble flow - can help reduce the risk of trash building up around tynes. For best results stubble tubes should be rounded, straight and vertical and fitted to the shoulder of the point to prevent a 'dead zone' that will trap stubble.

It is important, particularly given community concerns about burning and industry pressure to move away from cultivation, that decisions are reasoned and well based, with the pros and cons of each option weighed up carefully.

A reasoned, informed, evidence-based decision-making process may result in a grower deciding to:

- inter-row sow some paddocks
- work stubble residues into the soil in other paddocks
- mulch or burn in some areas

The reasons for these decisions will vary from grower to grower and location to location.

The key is to be flexible, explore all the options on a paddock-by-paddock or zone-by-zone basis and use the approach that will provide the greatest total benefit in each situation. The quickest and easiest option may not be the best.

It is important to start working through the issues early so there is sufficient time to reach the best decisions and implement them.

Maximise and match moisture for peak potential

WUE issues

- *Measure soil moisture and calculate likely Plant Available Water (PAW)*
- *Establish a target number of heads per square metre*
- *Test seed for germination and vigour ahead of seeding*
- *Use only good-quality seed – buy seed if retained seed is below quality*
- *Aim for perfect timing and seed placement and monitor seeding depth to maximise the chances of good emergence*
- *Be aware of the impact of some fungicides, herbicides and fertilisers on crop emergence*
- *Match nutrition to the available moisture*

The key to optimising yields is to make full use of all the soil moisture available.

The effectiveness of summer and pre-seeding weed control will play a critical role in determining how much moisture is available for the crop.

How much of that moisture is used to produce grain will largely be determined at or before seeding time.

To maximise water use efficiency (WUE) growers need to know how much soil moisture is present and use the best available information to calculate the amount likely to be available from rain during the growing season. To establish soil moisture, take soil samples to the expected rooting depth of the crop to be grown and use these to calculate the plant available water (PAW) in the root zone.

For growers with good knowledge of the 'bucket size' of the soil types that make up the profile in each paddock or zone, a simple push probe can provide a guide as to how much water is in the profile.

Calculate the expected total moisture available by adding anticipated growing season rainfall minus evaporation to the soil PAW figure and use this total to estimate likely yield. The French Schulz model suggests wheat will produce 20 kg/ha of grain for every millimetre (mm) of available growing-season moisture; which is a major

reason for controlling summer weeds. Every millimetre of moisture used by weeds is potentially 20 kg/ha less wheat in the bin. A loss of 20 mm of available moisture over summer will reduce yield potential by 400 kg/ha, which is \$100/ha for grain at \$250 a tonne.

Calculations for potential yield of three common crops are (kg/ha):

Wheat:

(soil water + growing season rainfall – 110 mm*) x 20

Barley:

(soil water + growing season rainfall – 90 mm*) x 20

Oilseeds:

(soil water + growing season rainfall – 110 mm*) x 12

*= evaporation

Soil nutrient test results and accurate calculation of PAW will provide a basis for calculating fertiliser needs for a crop capable of using all the available moisture and achieving 100% WUE.

Modelling can assist in understanding the complex relationships between soil water availability, water holding capacity, planting dates and rates, variety growing season length, temperature influence and nitrogen status of soils. Yield Prophet is a good example of a powerful yet

relatively easy-to-use model that can help growers and advisers understand and explore these interactions from which local ‘rules of thumb’ can be developed to assist decision-making processes. The Yield Prophet model is specific to soil type and geographic location so growers and advisers will need to extrapolate from the site-specific outcomes it produces to make decisions about crops on different soils and in different locations in the region.

When calculating seeding rates it is vital to take account of germination percentage and seed vigour, and it is important to have these tests done in the lead up to seeding. Do not rely on tests done at harvest or when the seed was put into storage. Storage conditions impact on grain quality and damp, weather-damaged seed stored at high temperatures will rapidly lose viability. The wet conditions during the 2010-11 harvest mean there is a high risk that germination and vigour levels were low at harvest and have further deteriorated in storage. It is important to test seed immediately prior to sowing to make sure germination and vigour are adequate.

If tests indicate germination and vigour rates are low, make a critical assessment of whether or not to use the seed. Growers who choose to test their own seed should work with their agronomists to make sure they use the correct procedures and accurately and objectively assess the results.

Wheat and barley with a germination rate of less than 80% should not be used for seed. For canola the cut-off figure is 90%.

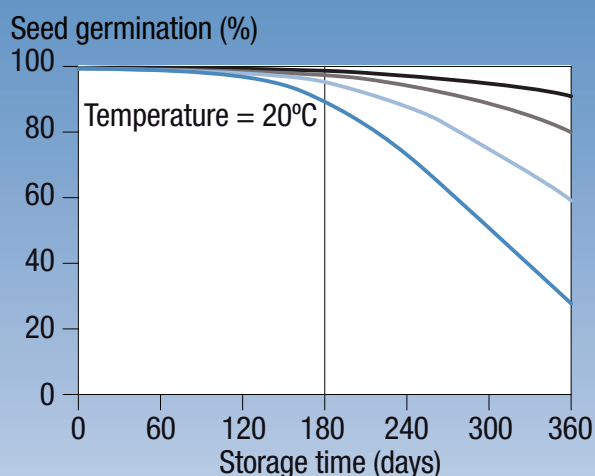
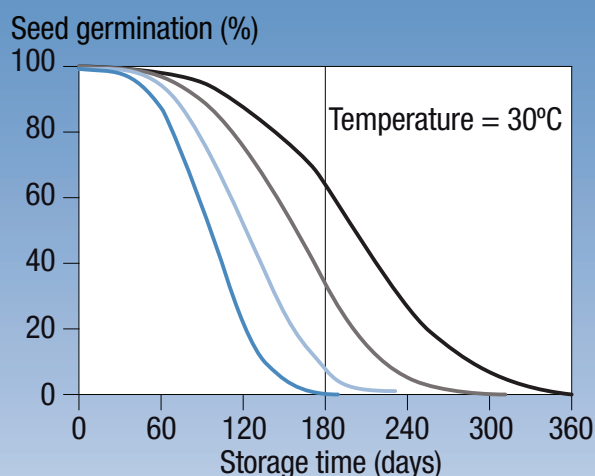
‘Crop topping’ desiccant sprays can also impact on seed viability, depending on the timing and the chemical used. Grain from crops desiccated with glyphosate **must not** be retained for seed.

If the quality of retained seed is suspect, consider buying seed from another source with higher tested germination and vigour. Using seed carried over from previous seasons may be an option, depending on how long it has been in storage and the storage conditions. In this instance too, it is important to have germination tests done to ensure viability levels are adequate.

Seed size is also a factor in seeding rate calculations. This requires measurement of the 100-seed weight, which is achieved by counting out multiples of 100 seeds, weighing the sample counted out then dividing the weight by the number of 100 seeds [e.g. for 500 seeds divide the total weight by 5 to get the 100-seed weight].

Vigour is a product of seed size and nutritional composition, so the emergence of samples with marginal germination percentages may be improved by grading the retained seed and sowing only the larger fraction.

Influence of storage temperature and moisture on seed vigour



NB: The figure on the left shows the influence of moisture content on germination of wheat stored at 30°C and the figure on the right shows the influence of moisture content on germination of wheat stored at 20°C

SOURCE: CSIRO Stored Grain Research Laboratory

$$\begin{array}{c}
 \text{Seeding rate (kg/ha)} \\
 \hline
 = \frac{\text{target plant density (pl/m}^2\text{)} \times \text{100 seed weight (grams)} \times 10}{\text{germination percentage} \times \text{establishment percentage}}
 \end{array}$$

Once you have all the relevant information, calculate your seeding rate using the above equation.

The issues then become timing, seeding depth and technique.

Correct seeding depth, conditions and agronomy are critical when sowing weather-damaged seed with low vigour.

The aim must be to ensure the best possible start for the seedling. This is critical for seed with low vigour, but even with top-quality seed is the first step towards maximising WUE.

Make sure it is as easy as possible for the germinating seed to reach the surface and establish. Sowing too deeply, cold or wet soil, some seed dressings and herbicides and hard setting soil can all reduce seedling emergence. If the seed is sown deeper than the length of the coleoptile the plant can fail to emerge. This risk increases when using seed of low vigour so needs to be front-of-mind for anyone thinking about sowing deeper than usual to avoid mouse damage.

‘the aim must be to ensure the best possible start for the seedling’

Coleoptile length is shortened by seed dressings containing the fungicides fluquinconazole, flutriafol or triadimol and herbicides such as trifluralin or pendimethalin. Growers planning to use weather-damaged seed need to consider very carefully whether or not they should use these products. Increasing seed depth can reduce the risk of damage from soil-active pre-emergent herbicides but coleoptile length then

becomes the issue once more. One option may be to use a variety with a longer coleoptile.

Assuming good germination and vigour levels, and no threat from digging pests such as mice, the ideal seeding depth for cereals is 30 to 35 mm for semi-dwarf varieties and 50 to 70 mm for tall varieties. Canola has small seeds and is usually sown 12 to 25 mm deep, depending on soil moisture. Lupins should be sown no deeper than 30 to 50 mm depending on soil type and species. Other pulses tolerate sowing at depths of 50 to 80 mm.

Avoid fertiliser coming into contact with seed, particularly when using the higher rates likely to be needed in many areas this season. The seeding systems used, the fertiliser applied and the crop selected will all dictate how close seed and fertiliser can be placed. Damage is likely to be worse with wide rows, minimum soil disturbance and with fertilisers that are high in nitrogen, have a high salt index or are highly alkaline. Canola seedlings are particularly sensitive to high concentrations of fertiliser so take particular care with seed/fertiliser separation when sowing canola.

The big stubbles present in many paddocks have the potential to adversely affect crop emergence through blockages. They may also impact on seeding depth and seed-soil contact. They are also likely to reduce the efficacy of pre-emergent soil-active herbicides.

Time of sowing can also impact on WUE. For maximum yield potential, sow longer-season varieties earlier and shorter-season varieties later. However, sowing some short-season varieties early in some paddocks can reduce the risk of crop failure due to lack of spring moisture and sowing long-season varieties late can help offset frost risk.

Nutrient management is also important. For optimum yields the available moisture needs to be matched with sufficient and balanced nutrition throughout the season for the crop to make full use of available moisture. Nitrogen can be applied during the growing season if soil moisture levels are good and the season looks favourable.

Don't guess on nutrition

Nutrition issues

- *Test and measure moisture and nutrient levels*
- *Apply the standard principles – only the moisture levels have changed*
- *Establish a realistic moisture-based target yield and be prepared to provide the inputs needed to achieve it*
- *Expect to apply higher rates of fertiliser this year*
- *Use soil N tests as a guide to nitrogen needs at seeding*
- *Take account of minor nutrients too, not just the 'big three'*
- *If finances are an issue concentrate resources on the best paddocks*
- *If in doubt, consider the risk of not achieving yield targets, not the fertiliser price*

The wet conditions during the 2010-11 harvest and into autumn make it difficult to get a clear picture of the nutrients available for this season's crops.

A lot of nitrogen (N) may have leached out of the root zone, especially in lighter soils, or been lost by denitrification in flooded soils. If this has occurred, has it been replaced by subsequent mineralisation over summer and autumn?

Where there are high soil moisture levels, ensure at least 30% of the total N required to achieve the target yield is available at seeding. This will give the crop a good start and ensure yield potential is not limited by poor early-season development.

Phosphorus (P) is less mobile than N, but the good crops in 2010 mean there were large off-takes of P last season. Identifying yield potential for 2011 and using soil tests to establish the P status of the soil gives a sound basis for planning.

The large volume of organic matter in paddocks adds another dimension. The impact of the stubble load on nutrient availability will vary due to:

- the amount of residue present
- moisture levels
- temperature
- the type and number of soil organisms present

- the amount of N available to the soil organisms

Grain protein also has an effect on N removal. Given these variables, the only way to be sure of what nutrients are available is to carry out deep-soil tests, particularly for N and sulphur (S), and use the results for nutrition decision-making for 2011 crops.

The size of last year's crops and the high moisture conditions mean growers need to look beyond N and P to the other elements that are also required for plant growth and crop development. These include S, potassium (K) and the trace elements, particularly zinc (Zn), copper (Cu) and manganese (Mn). There was Cu deficiency in some crops last season and responses to K were reported in several districts where this nutrient has never been considered an issue.

When calculating fertiliser needs based on last year's fertility levels growers need to take full account of the nutrients tied up in the large stubbles as well as what was removed in the grain.

There are about three kilograms of phosphorus in each tonne of wheat grain and about seven kilograms in each tonne of canola. In many districts, the amount of P removed in grain and stubble last season was two to three times the long-term average. Nutrients organically bound in stubbles may or may not be available to the coming crop depending on the rate of stubble breakdown and a variety of biological factors.

	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)	Sulphur (kg/ha)
Wheat (5 t/ha, 12% protein)	105	15	18	6
Canola (3 t/ha, 23% protein)	90	15	20	15
Barley (5 t/ha, 10% protein)	90	15	23	6

Approximate nutrient removals with major grain crops. Nutrient densities are taken from Reuter & Robinson, 1997.

Other factors to be considered when calculating fertiliser requirements include:

- previous rotations
- crop choice
- target yields

Ensure crops have sufficient nutrition to use the water available this year. And that goes beyond N, P and K. A trace element deficiency can limit yield just as dramatically as a lack of N or P. 'Adequate and balanced' is the key.

Soil testing provides the best starting point for managing crop nutrition. Use a topsoil (0-10 cm) test for P and most other nutrients, a deep-soil test for N and S and pay close attention to sampling methods.

'the only way to be sure of what nutrients are available is to carry out deep-soil tests'

Knowledge of soil reserves is essential for calculation of fertiliser rates.

To meet the crop's needs for target yields apply only the amount of each nutrient needed to supplement what is already available from the soil.

In most districts soil profiles are full of moisture so yield potentials will be high, provided weed control has been effective. It is important not to set yield targets unrealistically high.

Ensure there is no 'hidden' limiting factor such as a trace element deficiency and that the crop has enough P for

establishment and development and sufficient N for good seedling growth. Subsoil limitations prevent root access to stored water. Knowing the extent and pattern of these limitations will assist with allocating nutrients to the most responsive areas or paddocks.

If finances are an issue, risk management principles and common sense require that the available management resources and fertiliser investments be concentrated on the best paddocks and most profitable crops.

Never has it been more important to undertake soil tests to determine current soil fertility levels, because knowledge of soil reserves is the starting point for calculation of fertiliser rates.

When making decisions about P fertiliser use focus on minimising the risk of not achieving budgeted yield targets rather than the price of fertiliser. The strategies for determining P fertiliser rates are the same as they have been in the past.

Where cash flow and financial risk remain key pressures an option is to reduce production costs by limiting P rates but this is a short-term strategy that will mine soil reserves. These will have to be replaced at some stage and applying sufficient P to maintain soil reserves by replacing the amount of P removed in the grain at harvest is a very sound strategy for 2011.

Even moderate in-furrow fertiliser rates can damage crops sown using disc openers or narrow points on wide row spacings. With canola, even low in-furrow N rates (around 10 kg N/ha) can halve plant populations and damage is worse if the crop is sown into dry soils. Under these conditions, unless separating the seed and fertiliser by side or deep banding, avoid using higher rates of N at seeding and top up with in-crop N during the growing season.

Adequate trace element nutrition is just as important for vigorous and profitable crops and pastures as major elements such as N and P. Trace elements can be supplied in fertilisers applied at seeding, as seed dressings or as foliar sprays during the growing season.

Prevention the key to disease control

Disease issues

- *Disease prevention is better than cure*
- *Minimise the risk by eliminating the 'green bridge'*
- *Establish a wide rotation*
- *Grow resistant varieties if available*
- *Have a PreDicta B™ test or assay done to determine disease levels present*
- *Use decision support tools such as Blackspot Manager and the Blackleg Risk Assessor*
- *Apply appropriate fungicide protection at seeding*
- *Provide adequate crop nutrition*
- *Build foliar fungicides into the crop management program and be ready to spray if needed*
- *Actively monitor what is happening in the crop*

When it comes to crop disease, prevention is the preferred, lowest-risk and most cost-effective option.

All the indicators point to cereal, pulse and oilseed crops being under heavy to extreme disease pressure this season due to high-moisture conditions, high disease levels last season, the 'green bridge' and high stubble loads in many paddocks.

The disease risk is best addressed by:

- eliminating the 'green bridge'
- selecting varieties with resistance to the diseases most likely to pose the biggest threat, where such resistance is available
- appropriate management, including rotation, so crops are not sown into or near stubbles of the same species
- providing appropriate fungicide protection at seeding

It is important to note the potential for re-emergence of diseases such as take-all (hay-die) that are favoured by higher-moisture conditions.

Take-all is most active in better seasons and is capable of causing very large yield losses. Yields can be reduced by around 20% without any visible symptoms. If crops are stressed by hot dry winds during spring, root systems blocked by take-all can cause the crop to hay off prematurely.

Some small take-all patches were reported in 2010 and some early PreDicta B™ samples indicate take-all inoculum levels have increased. The disease could emerge as a significant issue in some paddocks this year, with cereal-on-cereal paddocks or cereals on grassy pastures at highest risk. PreDicta B™ can help determine the disease risk. Contact your agronomist to see if testing is justified and if so, take the soil cores along the rows of the previous cereal crop, which will help estimate maximum risk.

Paddocks with high levels of take-all inoculum should be sown to canola or pulses as take-all is easily controlled by growing a grass-free broadleaved crop. A year without grass of any sort will significantly reduce levels of take-all inoculum in the soil.

The warm, moist conditions over summer and early autumn should have reduced inoculum levels but there may still be a heightened risk, if self-sown cereals and grasses in this season's cropping paddocks are not controlled. Take-all inoculum will increase on grass weeds and cereal volunteers when soil temperature drops below 25°C so early removal of the 'green bridge' is essential. This will also reduce the incidence of rhizoctonia, which is hosted by cereals, grasses and broadleafed weeds.

In-furrow fungicides and seed dressings can reduce the risk of yield loss in paddocks when take-all inoculum levels are low to medium. Delayed sowing in these paddocks to the end of the seeding program will also help reduce take-all risk provided the paddock is kept host free.

PreDicta B™ will also identify the risk from other soil-borne pathogens such as **Pratylenchus nematodes**, which have also started to increase due to the better growing conditions in the past two seasons.

Cereal Cyst Nematode (CCN) may also become an issue this season, with volunteers from last season's large crops of CCN-susceptible cereals increasing the risk of massive nematode build up. Avoid sowing intolerant or susceptible varieties in paddocks or zones where CCN-susceptible crops were grown in 2010.

Time of sowing can also impact on disease risk in pulses. In 2010, sowing pulses too early increased the need for fungicide applications and reduced disease control effectiveness.

'the risk of cereal rust diseases is expected to be higher this season than at any time since the 1970s'

In cereals, however, early sowing can enable crops to avoid major impact from **rhizoctonia**.

The risk of **cereal rust** diseases is expected to be higher this season than at any time since the 1970s, so it will be important to avoid sowing susceptible (S) and very susceptible (VS) varieties, use fungicides at seeding – particularly to protect early-emerging crops from stripe rust - and actively monitor crops to ensure timely application of foliar fungicides if they are needed.

Use the latest disease rankings to select wheat varieties with resistant (R), moderate resistant (MR) or moderately resistant to moderately susceptible (MR-MS) responses to stripe and stem rust at least. Selecting varieties with different resistance genes will reduce the risk of losses if there is a change in pathotype.

Plan for in-season foliar sprays with wheat this year and:

- know what to expect with the disease response of each variety sown
- monitor regularly, particularly if using a variety known to be vulnerable
- maintain awareness of regional and district rust levels
- be prepared to act in a timely manner

With long-season wheats and triticales, heavy grazing can reduce an early burden of stripe rust. Applying a tank mix of fungicide with a broadleaf herbicide is also a cost-effective option.

Stubble-borne diseases such as **yellow leaf spot** in wheat and **blackleg** in canola are also likely to be prevalent, particularly in the absence of wide rotations. Identify paddocks at high risk of root disease and take appropriate actions to minimise those risks.

Yellow leaf spot disease was prevalent in 2010 so levels are expected to be high this season but the actual level of infection will be influenced by humidity levels and the variety sown.

Initial levels of yellow leaf spot infection are directly proportional to the quantity of infected stubble present so control measures should focus on reducing the amount of infected stubble. Other measures that will reduce the risk of yellow leaf spot are:

- including crops not susceptible to the disease in the paddock rotation
- sowing resistant wheat varieties
- timely application of fungicides where chemical control is warranted.

Septoria tritici blotch may also be an issue in early-sown susceptible crops.

Barley scald, favoured by early-sown crops and cool, wet conditions during winter months, is likely to be an important disease of early-sown barley during 2011. To minimise grain yield and quality loss from scald, sow later and use seed and/or early application of foliar fungicides to suppress disease development.

Spot form of net blotch (SFNB) will again require active management this season. Avoid susceptible and very susceptible cultivars and avoid sowing into paddocks with infected barley stubble. Foliar fungicides

applied between Z31 (stem elongation) and Z39 (flag leaf emergence) can suppress development of this disease.

Leaf rust and **powdery mildew**, both of which will be favoured by the 'green bridge', can be managed by using seed-applied fungicides, avoiding susceptible cultivars and monitoring to ensure timely foliar fungicide applications if needed.

The levels of **take-all**, **crown rot** and **nematodes** may be higher this season and it is important to consider root disease issues when planning rotations and paddock management.

Large amounts of disease inoculum will be carried over on pulse stubbles this season, so paddock selection will be critical. Aim to sow 2011 pulse crops as far as possible from 2010 stubble to minimise the chances of spore movement from stubble to the new crop.

Good disease management will also be essential to reduce the level of disease risk and potential losses.

'good disease management will also be essential to reduce the level of disease risk and potential losses'

Effective control of **chocolate spot** in faba beans and **botrytis grey mould** in lentils starts with a fungicide spray at pre-canopy closure.

The risk of losses from **chocolate spot** in faba beans can be minimised by keeping crop density below 24 plants a square metre.

Blackspot Manager spore release predictions are available on the web at www.agric.wa.gov.au/cropdisease

Using these predictions to schedule sowing of field peas to avoid exposing seedling crops to peak spore releases is the basis for minimising the risk of losses to this disease.

The cold wet winter and spring in 2010 kept **aphid** numbers and associated **viruses** at a low level but the 'green bridge' and mild conditions over summer have increased the risk of aphids and viruses in 2011.

In general, whether sowing cereals, pulses or oilseeds, stick to the basics. Choose the most suitable crop variety and sowing time to minimise overall risk. In recent years

early sowing was critical to success with pulses but with adequate moisture present early sowing is not the best option for all pulse varieties where disease risks are high.

For pulses, plan at least one foliar spray into the management program, ensure access to anticipated fungicide needs well ahead of when the chemical is likely to be needed and make sure your spray equipment is ready to go. Monitor crops closely and be prepared to act quickly. Complacency and delays with fungal disease management can be costly. Protecting healthy foliage ahead of infection is far more effective than trying to stop or cure an infection.

Note that fungicides used under emergency permits in 2010 cannot be used for these applications in 2011.

To minimise disease risk in pulse crops:

- Allow a break of at least three years (preferably four) between successive lupin and field pea crops to allow disease spore numbers in the soil to decline.
- Aim to separate this year's lupin, field pea or chickpea crops from stubble of the same crop.
- Use good-quality, high-vigour seed that is free from disease.
- Use a fungicide seed dressing that will provide six to eight weeks protection from disease and reduce levels of transmission of seed-borne pathogens.
- Make strategic use of foliar fungicides.
- Sow varieties that are appropriate for the district and have adequate disease resistance.
- Follow the recommended sowing dates, rates and agronomy information.
- Inspect crops regularly for plant and disease development and respond quickly if disease is found.
- Foliar fungicides work most effectively when applied early and disease levels are low.

The risk of **blackleg in canola** will be higher in 2011 and it is important to sow canola as far as possible from canola stubble of any age and use a fungicide at seeding.

A new decision support tool called the Blackleg Risk Assessor (BRA) will help with canola risk management decisions. The new tool, detailed in a GRDC Blackleg Risk Assessor Fact Sheet (www.grdc.com.au/GRDC-FS-BlacklegRisk), enables growers to determine their own blackleg risk paddock by paddock and adjust factors such as variety and paddock election to reduce risk.

Sclerotinia levels are also likely to be higher this season than in recent years. Crop rotation is the main method of control for this disease.

Apply good principles and pay attention to the detail

Pest issues

- *Remove the 'green bridge' to minimise pest pressure and associated spread of viruses*
- *Monitor paddocks and accurately identify the pests present and the damage potential before deciding on action*
- *Act to avoid or minimise problems ahead of seeding*
- *Mice, snail and slug control is likely to be difficult this season, so pay close attention to the detail*
- *Make sure control measures have minimal impact on beneficial organisms*

Good management and attention to detail will help minimise the risk of losses to pests in the coming season.

Many pests have been favoured by the high-moisture conditions in many areas and the generally mild summer conditions in most districts. The difficult harvest conditions and the proliferation of volunteers and weeds that have become a 'green bridge' for many pests and diseases are also significant factors. Pests favoured by these conditions include mice, slugs, snails and aphids.

Crickets, earwigs and lucerne flea may cause damage in the coming season. Large populations of crickets were reported in some districts in late summer and earwigs have also been active. These insects are thought to be favoured by high stubble loads. Lucerne flea will benefit from the high moisture levels present in most paddocks.

While these potential pests could cause damage, it is unlikely they will all be a problem in the same area and it is important to deal with the reality, not the threat. Aside from direct feeding damage, pests such as **aphids** can also transmit plant viruses that can be particularly damaging if crops are infected early. Physically check what is happening in your paddocks. If there is evidence that one or more pests are present, actively monitor the situation and measure the population. This will determine what control measures need to be put in place and possibly what to sow in that paddock.

It is important to accurately identify any pest that is present and be confident that it is or will be a problem. It

is also important to take account of the ecology. Insect pests come with predators and diseases and it is likely any pest population will be under pressure from 'beneficials' including beetles and other insects. Spiders and predatory mites can also keep pest populations down and spiders are already notably prevalent in some cropping regions this year. The benefits of any control measure will be maximised if beneficial populations are left intact to continue attacking the pest.

The high stubble load and the number of damaged paddocks mean many growers will use slashing, rolling, burning and possibly tillage for stubble management and to improve paddock condition so there is scope to achieve snail control while setting up the paddock for seeding.

Burning can reduce **snail** populations but may prove problematic this season if there are cool moist conditions leading up to seeding. Up to 40% of the snail population can survive in a paddock where there is green weed material when it is fired. Where green vegetation is desiccated ahead of burning the snail kill can be as high as 95%. Desiccation can also improve the efficacy of physical control measures.

Physical controls include rolling, slashing or mulching, and cabling or chaining – dragging a chain, cable or similar across paddocks to dislodge snails from standing stubble and damage them. All these methods work best in hot, dry conditions.

These control measures will not eliminate snails and where populations are large they need to be augmented by baiting.

The best time to bait is when snails are active and there is little food available. Typically this is soon after a fall of rain or period of cool moist conditions in late summer or autumn. Two to three consecutive days of cool moist conditions when food is scarce are required to achieve a high level of mortality from baiting. The amount of vegetation in many paddocks, plus the high moisture levels, volume of surface cover and extended periods of mild temperatures may mean it will be difficult to achieve good results from baiting this season.

When baiting it is important to:

- apply sufficient bait for the number of snails present and re-bait if necessary
- bait early before egg-laying commences
- spread bait when two to three days of moist conditions are forecast
- bait fencelines throughout the season to reduce the number of snails moving back into paddocks
- monitor treated areas to determine whether further baiting is needed
- use baiting as part of an integrated management strategy

If high snail populations are present in maturing crops harvest equipment and practices may need to be modified to minimise snail contamination of the harvested grain.

Timing is critical to achieve good levels of control, so on-going monitoring, using recommended counting methods, is a vital part of the management equation.

Counts should be taken before control operations and seven days after control to record effectiveness.

Slugs cause similar damage to snails but are more difficult to control physically because they live in the soil and under surface cover. They also tend to be nocturnal. Consequently, there is greater reliance on baiting for slug control.

The principles for slug control are similar to those for snails.

Determine the slug risk in your paddocks by regular monitoring using wet carpet squares, hessian sacks or tiles laid over slug pellets on the soil surface. Make each 'trap' 32 cm x 32 cm (10 % of a square metre). Check the traps after a few days and count the number of slugs in and around each one. Multiply the count for each one by 10 to estimate the number of slugs per square metre in that location.

More than one slug per trap indicates a significant problem. If there are more than eight slugs per trap the problem is severe.

Given the conditions in many paddocks, it is likely to be difficult to get an accurate indication of slug numbers or achieve good levels of control with baiting.

If conditions mean it is unlikely baiting will be effective, consider sowing paddocks with a history of slug or snail problems to crops that are less susceptible to slug attack.

Slugs and snails may be discouraged by cultivation, ideally two shallow passes with a disc followed by rolling to crush clods on the surface.

Mice are also likely to pose a challenge this season, particularly given the high base populations in many districts and the mild, high-moisture conditions over summer.

Habitat is a factor for mice and reducing stubble height by cutting or rolling will help limit mouse populations by reducing the cover available for them. However, food availability is the major driver of mouse populations.

The amount of unharvested or spilt grain remaining in paddocks after last year's harvest suggests mice could cause significant problems in the coming season.

Seed from pasture and weeds is also an important food source.

Monitor paddocks closely, and where necessary apply zinc phosphide bait. Baiting straight after seeding is the most effective timing.

Given the importance of food in the mouse life cycle, the starting point for any control measure is to reduce the amount of grain in the paddock and prevent weed seed set. Grazing hard and early with sheep will reduce the amount of grain left on the paddock surface and cultivation will bury seed making it difficult for the rodents to access.

Effective summer weed control will address the weed seed issue and provide 'green bridge' control benefits.

Reducing the grain available will also improve the likelihood of achieving good bait control.

There are three potential danger periods for crop damage – at seeding, flowering and seed set. The risk of late-season damage will depend largely on when mouse numbers decline.

Beyond these management measures the only option is baiting. The keys to achieving good levels of control with baiting include reducing other food sources, good timing and applying sufficient bait for the population present.

The carry-over and build up of various other pests will be disrupted by eliminating the 'green bridge' for an extended period of several weeks. This will break the life cycle of the pests and diseases that rely on green vegetation. Pests reliant on the 'green bridge' include aphids, which over-summer on weeds and volunteer plants.

The key is close monitoring of what is happening in the paddock, with quick and accurate identification of any apparent problem and early use of the most appropriate control measures.

Useful Resources

Strategic Risk Management Fact Sheet
2011 Farm Gross Margin and Enterprise Planning Guide (SA)

www.grdc.com.au/GRDC-FS-StrategicRisk
www.grdc.com.au/GRDC-FarmGrossMarginGuide2011

Crop Varieties

2011 SA Sowing Guide
2011 SA Crop Harvest Report
2011 Victorian Winter Sowing Summary Guide
2011 NSW Winter Crop Variety Sowing Guide

www.sardi.sa.gov.au/crops/publications/sowing_guides
www.grdc.com.au/GRDC-NVT-SACropHarvestReport2011
www.grdc.com.au/GRDC-NVT-VicWinterSowingGuide2011
<http://www.dpi.nsw.gov.au/agriculture/field/field-crops/winter-cereals/winter-crop-variety-sowing-guide>

Sowing

Stubble Management Fact Sheet
Retaining Seed Fact Sheet
Time of Sowing Fact Sheet (southern)
Targeted Nutrition at Sowing Fact Sheet
Crop Placement and Row Spacing Fact Sheet (southern)
Rotations Fact Sheet
Water Use Efficiency Fact Sheet (southern)
Canola – Growing Hybrid Canola

www.grdc.com.au/GRDC-FS-StubbleManagement
www.grdc.com.au/GRDC-FS-RetainingSeed
www.grdc.com.au/GRDC-FS-TimeOfSowingSouth
www.grdc.com.au/GRDC-FS-TargetedNutrition
www.grdc.com.au/GRDC-FS-CropPlacementSouth
www.grdc.com.au/GRDC-FS-Rotations
www.grdc.com.au/GRDC-FS-WaterUseEfficiencySouthWest
www.grdc.com.au/GRDC-FS-HybridCanola

Diseases

Root Disease Fact Sheet
Crown Rot in Cereals Fact Sheet (southern)
Rhizoctonia Fact Sheet
Rust Management Fact Sheet
Fungicide Timing Fact Sheet
Green Bridge Fact Sheet
Blackleg Risk Assessor Fact Sheet

www.grdc.com.au/GRDC-FS-RootDisease
www.grdc.com.au/GRDC-FS-CrownRotCerealsSouth&West
www.grdc.com.au/GRDC-FS-Rhizoctonia
www.grdc.com.au/GRDC-FS-RustManagement
www.grdc.com.au/GRDC-FS-FungicideTiming
www.grdc.com.au/GRDC-FS-GreenBridge
www.grdc.com.au/GRDC-FS-BlacklegRisk

Pests

Mouse Management Fact Sheet
Integrated Pest Management Fact Sheet
Aphids and Viruses in Pulse Crops Fact Sheet
Plant Parasitic Nematodes Fact Sheet (southern)
Diamondback Moth in Canola Fact Sheet
Wheat Curl Mite Fact Sheet
Plague Locust Control Fact Sheet
Bash 'Em, Burn 'Em, Bait 'Em booklet
Beneficial Insects: The Back Pocket Guide (southern)
Snail Identification and Control: The Back Pocket Guide
Slugs in Crops: The Back Pocket Guide
Wheat Rust: The Back Pocket Guide

www.grdc.com.au/GRDC-FS-MouseManagement
www.grdc.com.au/GRDC-FS-IntegratedPestManagement
www.grdc.com.au/GRDC-FS-AphidsandVirusesinPulses
www.grdc.com.au/GRDC-FS-NematodesSouthWest
www.grdc.com.au/GRDC-FS-DiamondbackMothSouthWest
www.grdc.com.au/GRDC-FS-WheatCurlMite
www.grdc.com.au/GRDC-FS-PlagueLocustControl
www.grdc.com.au/GRDC-FS-Snails-BashBurnBait
www.grdc.com.au/GRDC-BPG-BeneficialInsectsSouthWest
www.grdc.com.au/GRDC-BPG-Snail
www.grdc.com.au/GRDC-BPG-Slug
Not Online – copies available from Ground Cover Direct
Freephone: 1800 11 00 44
Not Online – copies available from Ground Cover Direct
Freephone 1800 11 00 44

Wheat & Barley Leaf Symptoms: The Back Pocket Guide

Weeds

Managing the Weed Seedbank Fact Sheet
Late Season Herbicide Use Fact Sheet
Glyphosate Resistance Fact Sheet
Herbicide Resistance Fact Sheet
Water Use Efficiency Fact Sheet (southern)

www.grdc.com.au/GRDC-FS-WeedSeedbank
www.grdc.com.au/GRDC-FS-LateHerbicideUse
www.grdc.com.au/GRDC-GlyphosateResistance
www.grdc.com.au/GRDC-FS-HerbicideResistance
www.grdc.com.au/GRDC-FS-WaterUseEfficiencySouthWest

These publications are also available in hard copy from Ground Cover Direct on Freephone 1800 11 00 44 or email: ground-cover-direct@canprint.com.au

