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Newsletter
SUSTAINABLE AND HIGH PRODUCTION AGRICULTURE – NOW!
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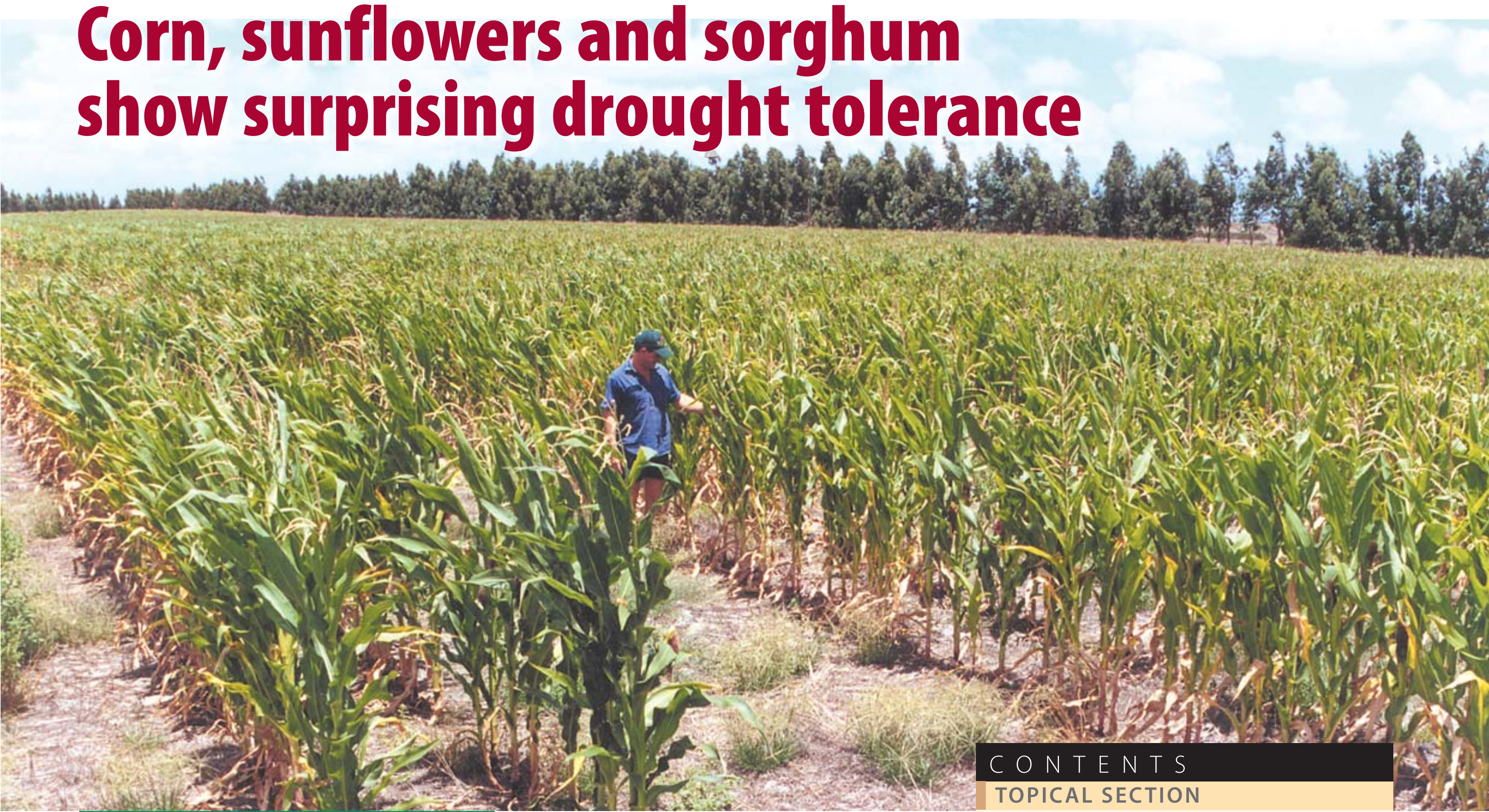
Corn, sunflowers and sorghum show surprising drought tolerance



Steve Pink's corn, shown here during late December, on double skip rows and with fertiliser, surprises all with large areas performing very well with almost no rain.

Despite the very dry winter, spring and early summer in WA, there are still warm season crops that have performed very well. Moisture accumulating sites have obviously done best but there are several grain crops, particularly on the south coast, that have held on through the dry. These have grown good crops with almost no in-crop rainfall. Yes, there have also been many farmers who did not plant these crops in the dry spring and some others who did, for one reason or another (dry soil, insects and low fertiliser), and did not get their crops to perform.

The trick to making these crops perform in drought environments, so it seems, is double skip row spacing and stubble retention. Farmers who have been pleased with their crops' performances are: Jim and Chris Kirkwood at Kendenup (sunflowers and sorghum), Ashley Jones at Ejanding, near Dowerin (forage sorghum) and Steve Pink at Munglinup (corn). For more on this see Craig Scanlan's story inside.

Warm Season Crop Field Day

A Warm Season Crop Field Day will be held at 12.30 pm at Ashley Jones's farm on Tuesday 27th February.

Rolf Derpsch and Carlos Crovetto (from South America) will be the visiting 'expert' contributors on the day.

WANTFA established some demonstration plots at the site during the mid-January rains. The main grain crops planted are corn, sunflower and sorghum demonstrating the effects of row spacings, fertilisation and varieties. There are also some demonstration plots of several other crops.

The demonstration site is north-east of Amery, 13 km along the Old Koorda (gravel) road, on the right. Look for the WANTFA signs.

Local speakers include Angie Roe from Farm Focus, Steve Addenbrooke from Pioneer and Wayne Smith of Agronomic Acumen.

Thanks to NHT and Pioneer Seeds for funding these demonstrations; Ashley Jones for providing the land and temporary fencing; and Rob Pressor from AgriTech Crop Research for managing

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Website password
Please note that your username and password for the website are: **wantfa** *and* **no-till**

the research—especially given such hot and testing conditions combined with operating precision seeding machinery that is new to WA.

Calcium:magnesium ratio?

Rochelle Strahan from Ongerup, University of WA agricultural student, has just completed an honours project on the effect of the soil's Ca:Mg ratio on wheat and lupin growth.

She has also reviewed the scientific literature. Rochelle's conclusions support the idea that the ratios have some relevance to WA soils (see her report in this *Newsletter*).

WANTFA has two long-term trials, set up during 2000, at the Meckering R&D site where the soil Ca and Mg ratios have been adjusted with either calcium or magnesium sulphate. Sown in late July 2000, after rotary hoeing the soil to 15 cm depth, the barley trial suggests that a ratio of 1:1 might be causing a yield penalty. For more thoughts on this approach come and hear Jan (or Yarn) de Jager at our Perth BEELINE WANTFA Conference.

Rotomill® for ryegrass control!

Harvestaire are developing a new method of mechanical weed control. Many of you may have seen the Rotomill® on display at the 2000 machinery field days.

The Rotomill has exciting potential to help in the fight against herbicide-resistant weeds. University work by Dr Michael Walsh has shown that ryegrass seed passing through the Rotomill® can be completely destroyed. Michael will speak on this at the February 2001 Conference.

"Exciting new Rotomill® from Harvestaire—congratulations!"

Harvestaire only released a few units for the harvest just gone. These tests suggest that the Rotomill®, in its current form, may struggle when high volumes of seed and chaff pass through it. Hopefully, further refinement will make it more robust. In the future, a successful unit is likely to eliminate the need for chaff carts and widespread burning of heaps and windrows. This would be good news for farmers who want to retain stubble and chaff as food for the soil.

The Rotomill® is made from a strong bisalloy steel—which is high in carbon. The unit destroys seeds by 'smashing' them between 12 rows of teeth, six of which are rotating at 3,000 rpm. The machine will kill many weed seeds as well as small grain. On a cautionary note, one farmer who is well experienced with chaff cart use, said that it is almost impossible to stop many (perhaps 30%) of the ryegrass seeds from being blown out the back of the header.

Tall wheat stubble improves Canadian pulse and wheat yields

Some innovative Canadian researchers have shown that keeping stubble tall, in a semi-arid region and with no-tillage, can increase crop yields.

The researchers sowed spring wheat, lentil, field pea, and desi chickpea crops into cultivated, short (17 cm) and tall (25–40 cm) spring wheat stubble. The various stubble treatments

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were manipulated just before seeding. Note that in their climate it becomes warm quickly after seeding and it may be dry for long periods afterwards. Our situation is obviously different.

Compared with cultivated stubble, the average yield benefits for seeding into short stubble were 6%, 10%, 4%, and 4% for spring wheat, chickpea, field pea, and lentil, respectively; while for seeding into tall stubble they were 12%, 13%, 6%, and 20%. The standing stubble changed the microclimate near the soil surface by reducing soil temperatures, solar radiation, wind speed and evapotranspiration—even after the crops grew above the stubble.

Spring wheat, lentil, chickpea, and field pea all grew about 2–7 cm taller with tall stubble than with cultivated stubble. The lowest pod height was about 2 cm higher with short stubble, compared to cultivated stubble, and a further 2 cm taller than short stubble when grown in tall stubble. Only chickpeas, in 1998, yielded less when grown in tall as compared with short stubble. This may be due to shading effects on the relatively small chickpea canopy that grew entirely within the tall stubble.

The researchers involved are Herb Cutforth, Brian McConkey, Dan Ulrich, and Perry Miller from Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada, fax (306) 773-9123 or MCCONKEYB@em.agr.ca.

Air diffusers for wide rows

During a recent study tour to NSW we met prominent Walgett farmer Mick O'Briene who finds air diffusers make row spacing changes on air seeders more practical.

Without the diffusers, farmers who modify their air seeders for wide rows by putting more than one hose into each opener are often frustrated by either too much air (which invites seed bounce) or too little air (which causes blockages). The diffusers allow you to maintain high air pressures while stopping seed bounce by releasing the air pressure at the top of each engaged opener.

Gyral air diffuser allows four inlets into the one opener without seed bounce or airflow problems.

Disc versus knives for warm season crops

NSW farmers acknowledged to our touring group the strengths and weaknesses of both seeding openers.

The discs are able to be used more quickly after rain as less horsepower is needed to pull them, making trafficability more possible. The discs also promote less weeds, decrease water loss and can provide precise seed placement. The problem with the discs is that they will smear in some soils, can struggle with soil penetration, and can hairpin without residue managers.

The knife points are able to penetrate in almost all soil moisture conditions—enabling moisture seeking. The knife points also self-clean in heavy soils. They also can create a wide and deep furrow which can catch rain water, if rain falls after seeding. This furrow system requires that loose soil is dragged back over the furrow, usually by a chain, to reduce evaporation from capillary rise from wet soil.

Observations from a disc seeder (John Deere Max Emerge Plus) at Dowerin in January 2001 have shown that the discs did not mix the wet subsoil with dry topsoil. The seeder left the dry sandy soil on the surface. This should provide some insulation against evaporation as compared to a knife point which may have exposed the wet subsoil to more evaporation.

Locusts and no-till

Several observations from the past spring and summer show some "fors and againsts" with no-till and locusts.

Luke Sprigg from Morine Rock noticed that where he had sprayed paddocks out on the summer rain that the locusts tended to move onto other sites, where the weeds were not sprayed, to lay their eggs. In contrast, an AGWEST staff friend from Esperance, told me that he noticed more egg beds in no-tilled paddocks.

While at Munglinup in December visiting several farmers, we noticed ants retrieving eggs from an egg bed under a mallee root. Closer inspection showed that the eggs were locusts. We know, from many observations on many farms, that no-till increases ant numbers. Therefore, mature no-till paddocks are likely to have a high locust predation capability—and perhaps other pests also.

Below: Black ants pull locust eggs into an ant hole at Munglinup.

Meckering Field Day is 18th September 2001

Please put this year's Field Day date in your diary.

We hope to make it even better than last year's Field Day which was rated highly by attendees. Results generated from 2000's trials will be published in a booklet soon, and will be available on the member's section of the WANTFA website (www.wantfa.com.au) in March 2001.

However, the high cost of printing complete booklets for all members has caused us to limit the number we are going to produce. WANTFA will only print a nominal number above those directly ordered. They will be available for $15 to members and to those who attended the Meckering 2000 Field Day (included in the cost of your attendance fee). The cost to non-members will be $25.

Subsequent *Newsletters*, however, will contain results from the site and also from other trials, as will your member's website.

If you would like to order a copy of the *2000 Trial Results*, please fax or email your request to WANTFA by 22nd February.

Compaction limits claying result

Unfortunately the large areas of claying at Esperance gave disappointing results in 2000.

Two factors combined to stop the crop from finishing. Clay retains more water than sand, so in an extremely dry spring, crops on clayed soils can be worse than on unclayed soils, due to decreased moisture availability. Secondly, soil compaction, as measured by Jeremy Lemon from AGWEST Esperance, greatly limited the root growth. Penetrometer readings show very high compaction on clayed soils—down to 60 cm depth. The previous two summers (1998/99 and 1999/00) have been very wet during the claying period and this has allowed the heavy claying equipment to compact to depth. Previous work by Bill Crabtree in the mid-1980's showed small responses to ripping these duplex soils which have a consistent sandy texture.

It is clear that these soils will now need some form of ripping. Perhaps a DBS Ausplow or a Nichols seeder might be adequate, along with crop types that can grow into tight soils at depth. If an Agrowplow is used, then doing this after seeding—as done in the northern regions of the state—would give the tidiest result. Adopting a tramline system would also make a lot of sense.

The Leymann scraper was used to clay a Meckering trial. This photo shows the wheel tracks which greatly reduced the lupin yield!

No-till has not helped frost risk

While no-tillage is helpful in dry years, it is clear that no-till does not offer any advantage in frost situations.

Many farmers have commented that in the last several years, when they have had high crop yield potentials, often with no-till, the frost damage has been severe.

A South Australian consultant has observed more regular frosts in high yielding crops. This is possibly because, in these crops, the soil has lost most of its stored soil moisture by September and this dryer soil is not 'temperature buffered' (able to release heat from stored soil moisture) on cold mornings.

How can frost risk be reduced? Professor Tim Reeves from CYMMIT, at last year's Crop Updates, mentioned a gene that makes wheat frost-tolerant, to at least -7°C. Acceptance of genetic engineering is needed initially, and then it might take 5–7 years before it can be inserted. Potassium has been mentioned as a frost-risk reducing nutrient. While this might be somewhat true, it does not explain why crops in potassium-fertile valley floors still get frosted. Although, to be fair, these are the most frost-prone areas.

Perhaps wide rows will reduce frost risk as Craig White (then Merredin AGWEST) observed during 1998. However, other agronomists have experimented with 50 cm wide rows with minimal result. I wonder if 100 cm rows would reduce frost risk? Obviously, weeds would need to be controlled with non-selective herbicides in such wide spacings.

Hooded sprayers, as Mike Collins and Paul Blackwell have been experimenting with, might be part of this approach. Scott McCalman (one of our WANTFA conference speakers) has also been doing this on a large scale in NSW for many years.

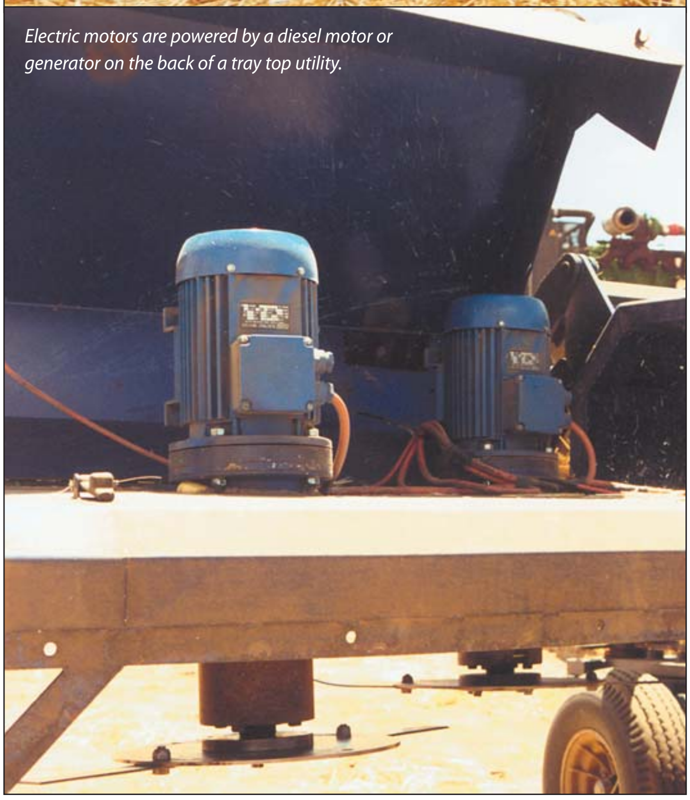
Slash that straw

Many farmers struggle with seeding through high levels of stubble. While this might not be an issue for many farmers this harvest there will still be some paddocks that will be a challenge.

If the stubble was not cut short at harvest time and spread evenly over the whole surface, then slashing might be a good option to consider.

We all know that stubble is invaluable at retaining moisture, once the rainfall gets through the stubble layer to the soil. Stubble also reduces disease splash and retards weed emergence and growth. It also makes weeds a little harder to target, but also makes them more moisture sufficient—enabling better leaf uptake.

A new service is provided to WA farmers who wish to retain more stubble and still be able to seed through thick stubbles (usually with wider row spacings). Hardcut Industries provide such a service (see their ad inside this *Newsletter*).



Electric motors are powered by a diesel motor or generator on the back of a tray top utility.

More Study Tour places available

Now that people have reviewed their budgets, and we have a firm price of $7,000 on the South American and South African study tour, which includes airfares, bus hire and accommodation, some people have withdrawn.

This creates an opportunity for you to join us. The tour is for 24 days from the 31st July 2001. Please fax your request to Monique for further information to (08) 9622 3395.

Surviving after a third tough year

Surviving 2001, for many farmers—including no-tillers—will be difficult. Many farmers who have had consecutive frosts and then a drought—along with high cropping inputs in at least two of these years—are finding it tough. Many will have to cut costs. We all know that this is not desirable and may have some negative long-term consequences.

So which costs can you 'afford' to cut? Perhaps leaving phosphorus off the crop legumes and leaving lime off soils with a pH of greater than 4.7 (except in canola paddocks); perhaps sowing pasture legumes instead of the more expensive crop legumes and then doing the usual spray topping? These pasture legumes leave more nitrogen in the soil for subsequent crops than crop or stock legumes. Choose crop varieties with disease-resistance and high yielding potentials.

Consider precision technology to reduce overlap and underlap and therefore make more efficient use of seed, pesticides and fertilisers. Many NSW farmers get a Beeline contractor (Spittle's from Westclay on (08) 9072 0666 are available in WA) for a few dollars an acre to mark lines and then with, say, chickpeas, these farmers adopt 100 cm row spacings and spray Bravo on only the chickpeas and glyphosate on the interrow. For more on this, come and hear Scott McCalman at the WANTFA Conference.

In 2000 we all learnt that a timely glyphosate spray after summer–autumn rains is essential. Small fresh plants sprayed early in the morning, perhaps until the foam disappears on the previous lap (as one farmer suggested) will ensure the best control.

If you are worried about waterlogging then consider grain sorghum as a real possibility. This is planted after the winter wet and will not get frosted.

Also, don't panic, but plan thoughtfully with your partner/s and consultant and be well prepared before the break. Don't let the dry spring of 2000 warp your judgement! Ensure that the seeder, truck and tractor are ready to go early, as early sowing can return good yields—even if we have only 60% of our normal spring rains.

Make sure the weedy paddocks go in last and perhaps leave them out all together if they are looking too dirty. Sowing Cadiz into these dirty paddocks late, after a knockdown which is applied near the end of seeding, and not grazing but spraytopping, could make good sense. Also, sowing lupins as a brown manure crop (sprayed out) could be a good option. And if it produces good grain yield, and the weeds are fewer than expected, they could be crop topped and harvested.

Don't use high rates of trifluralin—they don't give much extra response—see results from previous year's *WANTFA Newsletters*. But do apply trifluralin immediately before sowing for the most efficient result—perhaps mount a spray line on your seeder.

All the best!

President's Report

A review of the year 2000 for many is painful, for many reasons. We cannot change anything that happened but we must analyse our logic and reasoning through summer of last year to make sure of a number of things.

- Predictions of rainfall and major seasonal dramas very often do not eventuate.
- Preserving Jan to April rainfall for normal winter crops can give huge lifts in yield.
- Strategic early spraying, in the $4–6/ha range, can be very successful if it is the first germination over summer-small weeds use lots of moisture.
- Identifying the early spray opportunity is sometimes very difficult—experience helps.
- Retained stubble is an important factor for moisture retention.
- Sheep work against the above and should be kept on non-cropping areas.
- The year 2000 was a classic No-Till year and we can all learn a lot from it. If you had a bad year, do not be too hard on yourself, as it was one of many extremes and
- For some in WA it was a late break, a short winter and no spring—that is tough!

Conferences

Our Annual Conference is now close and this edition is timed to reach you just before that period. I look forward to seeing many of you at one of the three venues—Esperance, Geraldton or Perth. The decision to move the main event from Muresk to Perth, for a one year trial, was not an easy one as we know some people prefer Muresk. Many reasons come into this debate including strong indications from a lot of people for the event to be held in Perth. The committee needs your feedback on this, the best way being to attend and fill out the survey form at the end of the conference.

An excellent group of speakers will communicate their knowledge and experience to inform and challenge each of us.

Another powerful aspect is the opportunity to mix and interact with speakers and other attendees. The evening sessions have proved particularly successful for this. Once again a large amount

of thought, planning and time has been needed, with special thanks to Neil Young, Bill Crabtree and John Duff. The South American connection with Carlos and Rolf is quite something to look forward to, combined with a good balance of researchers and farmers.

Take-home messages to improve our profitability and rewards from farming; sharing experiences with others; gaining confidence by changing farming systems that we can be more consistently successful and sustainable; increasing awareness of the attention-to-detail; the need to put stubble retention in cropping programs—these are a few of the benefits that I have gained from being involved with WANTFA Conferences. The unselfish sharing of ideas and experience is just wonderful. I hope that you can all reflect and feel all these things plus more, by actively being involved. If you have not, then you can be!

AGM

Will be held before the start of the second day in Perth. I hope you can make it as it is a real chance to have your say about WANTFA and how it progresses. There are predictably a few changes on the committee. I will be standing down from the President's role after a three-year term and I wish the incoming President a wonderfully rewarding experience with an excellent committee to work with.

If anyone has a strong desire to be on this committee, please make this known before the AGM to myself, Bill Crabtree or another committee member.

Ministerial funding

Recently announced, there has been a funding package of $300,000 to assist WANTFA in a number of ways over a two year period.

One of the benefits of funding is the continued employment of Matt Beckett who has continued a good working relationship with Bill. This is a joint initiative of Monty House, AGWEST and WANTFA. A special thank you to Monty House and his office for having a genuine interest and understanding of what WANTFA is achieving. We continue to enjoy the fact that Bill and Matt are both working out of the AGWEST office in Northam. This funding will help the close cooperation that we are enjoying with AGWEST to continue.

Matt Beckett

Thank you to all at the AGWEST office in Northam.

Warm season crops

A very limited trials program has been conducted in line with the very dry last four months. Some trials were seeded in late January as a response to rainfall. Results of these efforts will be watched with interest as the timing is possibly too late for maturing grain prior to winter.

The point is nobody really knows in this environment how such late seeding will perform. Thank you to Jeff Burton and Derek and Glenn Chisholm for providing the sites and their help, and also to Ashley Jones at Ejanding for the main site.

Rotations site

Work is continuing to achieve this aim. The recent application for funding through GRDC was unsuccessful and new and different sources of funding will be required to establish this site. Partnerships and sharing of resources are key factors in almost any funding today and this is good logic for many reasons.

Thank you

This is my last President's Report and it has been a privilege to communicate directly to so many people. I will not be leaving WANTFA, as there is such a lot to the organisation and what it can offer to anyone keen to be at the leading edge of sustainable agriculture. I have strong views about the need for me to move aside and make way for new and energetic people. This principle applies to all organisations.

Time to thank a few very special people; to Bill Crabtree, who has been without doubt such a huge but humble figure in the No-Till arena—you have been an inspiration to work alongside.

To all on the committee, past and present, thank you for your respect, friendship and intelligent input with frankness. To Neil Young for being the best Vice President one could have. To John Duff, Carl, and to the hundreds of other people that I have had the privilege and pleasure of meeting or working with—thanks!

Warm Season Crop Study Tour —January 2001

Angie Roe, Farm Focus Consultants (08) 9622 5095

I have just returned from an inspiring and thought-provoking tour of the Warm Season Cropping (WSC) regions of SA and NSW. Wayne Smith (Agronomic Acumen) and myself took a small group of interested farmers, and spent a week driving through the southern half of SA and the central west of NSW, investigating the potential for WSC in WA. Bill Crabtree also came along, which made for some interesting and dynamic discussions and debates!

We all returned feeling confident that these crops **can** be grown in our often harsh environment, and that they may, in fact, have an important role to play in our southern dryland farming systems. We would all like to see initial research efforts continue in WA, to determine the best way to grow these crops, and to find out where, and when, they might best fit our individual farming systems.

First stop was SA, where we met with Dr Nigel Wilhelm (SARDI Sustainable Farming Systems Leader, and a speaker at last year's WANTFA conference). WSC is a relatively new concept in SA, with Nigel and a handful of leading edge farmers (including Brett Roberts, who also spoke at last year's Conference) paving the way in research. Nigel took us up to Tarlee, to a Field Day at one of his WSC trial sites, where 160 farmers and industry people had gathered (despite the high temperatures) to find out what WSC is all about.

The SA–NSW touring group.

The site is situated in a 475 mm rainfall zone, on a red-brown earth soil type. The trials were no-tilled into a thin layer of stubble with knife points and press wheels. A number of species, including grain and forage sorghum, corn, sunflower, millet, safflower, cotton and lab lab are all doing very well, considering the heat and lack of in-crop rainfall (38 mm since sowing on 9th October). Different row spacings (0.5 m, 1 m, 1 m skip and double skip) and fertiliser rates (of N, P, K, Zn and Mn), banded with and below the seed, and some foliar trace elements applied 7 and 11 weeks after seeding, have been included in an effort to determine some 'best bet' management practices for these crops.

These trials are repeated out at Waikerie, in a 250 mm rainfall zone, on sandy, calcareous mallee country. As we headed east into country resembling the station and mining areas of WA, we began to have serious doubts about the sanity of our SA friend, and the cry went out, "No way—you can't grow WSC out here!" But they can. There the crops were—alive and green (although they won't be breaking any yield records!). It was at this point that we realised WSC **will**

The dry Waikerie site has actually grown some reasonable corn, sunflowers and other such crops. Nigel Wilhelm explains to some locals and our touring group how things were done.

grow in WA. We just have to learn **how** to grow them.

After visiting a few local farmers (and wineries) throughout the Clare and Coonawarra regions, we flew into Sydney and headed out to Gunnedah, in central NSW. From Gunnedah, we did a circuit around Narrabri, Moree, Bellata, Walgett, Warren and Narromine with Todd Jones (Pioneer Area Sales Manager, Northern NSW and Liverpool Plains). Todd took us to see a number of farmers and trial sites, as well as a research farm, a local re-seller and the Pioneer Hi-Bred Seed Plant in Narromine. It was hot, dry and flat, and there always seemed to be a mirage on the horizon. There were a few moments when I wondered how **anything** could grow out there!

WSC have been grown for many years in NSW, in both irrigated and dryland situations. The main crops being grown in the more arid regions are irrigated and dryland cotton, and grain sorghum. There is also corn and sunflower in the eastern districts, but these crops become few and far between as you head west into the lower rainfall areas. Annual rainfall ranges from 500–750 mm, in most of the central and western regions falling to 450 mm in the west. Half of this falls in summer, and it is highly variable. Soil types range from deep cracking clays to friable black soils, all alkaline, and far more fertile than our own soils.

Most of the WSC we saw are sown on 1m, 1m skip or double skip rows with precision knife or disc machines (similar to the MaxEmerge Plus WANTFA recently bought). A no-till seeding system with maximum stubble retention is not considered vital to the success of these crops, and we saw many paddocks which had been worked, and which had had most of the stubble removed. Although these crops had an acceptable yield potential of anywhere from 1.5–5 t/ha, we couldn't help wondering if it might be possible to increase yield using no-till and retaining stubble (to maximise moisture retention), or if they might grow sunflower and corn further west under such a system. On the other hand, perhaps we are wrong to think WSC won't succeed in WA without no-till and stubble?

Towards the end of the trip, we met with a group of farmers known as the Walgett Sustainable Ag Group (WSAG), who are using Beelines and Tramlines to reduce costs and compaction, and maximise production.

Hugh Ball's sorghum on skip rows.

WSAG's past President Mick O'Brien's Janke precision and dual purpose seeder.

Jo and Scott McCalman.

These guys farm in a highly variable 450 mm rainfall zone which, until recently, has been grazing country. They are now cropping, and are becoming more WSC orientated in order to spread their risk over a greater part of the year.

We also visited Scott and Jo McCalman at Warren (both BEELINE WANTFA Conference speakers for 2001) to discuss their innovative seeding and spraying machines, and cool season/warm season cropping rotations. To hear Scott and Jo for yourself, be at the WANTFA Conference in late February/early March. They are both very innovative and extremely 'good value' speakers.

With our foot flat to the floor as we crossed the Blue Mountains in our powerful 22 seater mini-bus, we made it to the airport in time to jump on the plane! We all agreed the trip was well worth the heat, sweat, dust, and warm (overly chlorinated) motel pools—we are now ready to tackle WSC head-on!

Above: Tramlining in a paddock at Hugh Ball's place—hot enough to have a mirage in the background!

The McCalman's dryland cotton crop.

Grazing management of sorghum

Trevor Lacey, Farming System Development Officer, AGWEST Northam, (08) 9690 2101

Forage sorghums should be grazed when they are 80–100 cm in height. Younger plants may contain toxic levels of prussic acid, where as the protein levels and feed value starts to decline in plants greater than 100 cm high.

To maximise regrowth it is recommended not to graze below 15 cm height.

There has been a reported loss of several cattle grazing on 15-month-old ratooned sorghum plants. Following recent rains in some parts of the state there has been considerable growth/regrowth of sorghum. When sorghum is growing rapidly with new growth less than 80 cm tall, cyanide (prussic acid) builds up in the plant tissues causing poisoning. Once toxic, the sorghum will affect any grazing animals, including sheep, goats, cattle and horses, although cattle seem to be more susceptible than sheep.

Prussic acid toxicity can be:

- Chronic (sub-lethal)—leading to a reduction in live weight gain and milk production. Chronic toxicity will often go undetected. The use of sulphur blocks is recommended when grazing forage sorghums. Sorghum is often low in sulphur and animals may become deficient. Sulphur is also used in a detoxification reaction within the animal.
- Acute—where animals die within two hours (and as little as 15 minutes) of ingesting a lethal dose of forage sorghum. Although the number of stock deaths resulting from prussic acid poisoning are low, it is important to minimise risk by using the correct grazing management. Acute poisoning often results from hungry stock being put onto young or stressed crops.

Stock should be monitored when introduced to sorghum suspected of being toxic. Continuously monitor stock over the first hour and then intermittently over the next few days. Affected stock may die within minutes of eating a lethal dose of forage if not treated promptly.

Symptoms include; rapid heavy breathing, frothing at the mouth, muscular twitching and convulsions, staggering and coma. The usual treatment for the problem is with oral drenches of photographic sodium thiosulphate, but intravenous and intramuscular injections are required for best effect. Refer to your local vet for details.

Note: Prussic acid poisoning is rare. The use of forage sorghum as a high value feed is not discouraged provided the recommended grazing management is followed.

There are quite large differences in the levels of prussic acid in the different sorghum varieties. While all sorghums contain some compounds which generate cyanide when eaten (cyanogenetic glycosides), levels vary significantly between varieties. Grain sorghums and sweet sorghums often tend to have higher cyanide levels than other varieties.

Common varieties and relative cyanide content

Variety	Prussic acid potential
Super Sudax	Very Low
Sudan	↓
Speedfeed	↓
Zulu	Increasing
Cow Chow	↓
Jumbo	↓
Sugardrip	↓
Sugargraze	High

Strict grazing management is required during the early growth/regrowth stages of all varieties containing relatively high levels of prussic acid. ■

GM Crops—their future in Australia

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The public debate in Europe regarding GM crops reached hysteria early in 2000. The arrogant attitude of companies like Monsanto didn't help. They failed to address the basic nature of public concerns regarding this new technology.

They claimed results from the US and Canada suggested that it would not be a problem for Europe. However, the Europeans [and UK], were still reeling from the BSE issue and the Dioxins scare in chickens. The public lost faith in the scientific 'experts' and the farming community in general.

Despite these concerns that I observed in Europe, and after visiting a more positive North America, my conclusion now is that Australia should embrace GM technology in our production systems. This will ensure Australia does not become less competitive compared to other countries that will use GM crops. Marketing ourselves as "GM free" may be a short-sighted. Rather, I think we need to be pro-active to ensure that we make the most of this technology, without becoming slaves to major multi-national companies who currently control this science. To achieve this I recommend the introduction of a working end point royalty system.

What are the issues?

Competition in the food retailing sector has meant that non-GM foods have become a marketing issue. The supermarkets home branded products are all now non-GM. Before the debate flared up—the GM foods were being sold and clearly labelled and the European public had no problem with them. This debate was helpful to groups like Greenpeace—who needed an issue to galvanise public support. There are four main debating issues regarding GM crops.

Ethics

This debate relates to the philosophical view of man's role in interfering in nature, in this new science. It is largely a personal issue—but needs to be treated on a case by case basis. Transferring genes from animals to plants draws more attention than the plant to plant transfer.

Food safety

Will these novel foods cause food safety problems in the future? Probably not, but the public needs to be convinced by scientific evidence, it is no use trying to brush this issue under the carpet—consumers need to be respected.

Environmental

This takes many forms and includes a loss of bio-diversity and increased monoculture. This could reduce the food supply for birds and insects as changes to the intensity of agriculture can impact on wildlife, particularly in Europe. Could these GM genes upset the environment and will resistance genes 'escape' and cause harm to non-target insects or become "super weeds"? Will the crop itself become a weed as it follows other crops in the rotation? The environmental issue is the focus of many scientific trials which will take many years. The public will need to be included in the process for them to understand the issues.

Commercial

Multi-national chemical companies generally own the technology and they will aim to maximise profits. What effect will this have on the farm sector and on markets and what regulation is needed to ensure responsible use?

The Commercial debate is the main focus of my Nuffield Scholarship, from my travels in Europe I have gained a strong appreciation of the importance of producing quality product for the consumer. In Europe this focus has been distorted by producers' focus on subsidies. Many farming decisions are based on how to get the most from subsidies rather than on what the market wants.

Market acceptance

With full supermarket shelves in Europe the consumer doesn't see the need for the initial GM foods. In the excitement over the potential of this new technology the basics of food marketing seem to have been forgotten. Monsanto plan to re-coup a return on their investment from first generation GM crops—before the second crops are grown—which will have more of a consumer focus.

The second generation GM crops will be modified to include specific traits for direct end use—like better feed for chickens, or even greater health benefits to humans. The public in Western societies will demand 'choice' as to what they eat. GM crops need a market and the consumer must be willing to accept them.

When GM tomato paste was first sold in the UK it was labelled as GM and packaged in a larger container at the same price as non-GM paste. Consumers accepted this, perhaps out of ignorance, and perceived value for money. After the GM scare and US grain was imported and not labelled as such, all GM products were taken off the shelves. Was it European consumer backlash or marketing?

This reaction is a threat to GM crops. Monsanto, now recognise this and plan to consult the public and provide them with more information to reduce the hysteria. They plan to demonstrate the value of GM products by showing environmental benefits, better product quality or better price—discounting price might not appeal to farmers. The program will require the help of agri-business.

Producing consumer driven GM crops might help increase public acceptance. Demand for these products could pull them through the supply chain, rather than forcing them through to the consumer.

Profitability—farmers vs multi nationals

There has been a massive investment into GM technology by life science companies. Recently many of these companies have merged as they jostle for position to gain control of world crop genetics. Obviously, they see sales of seed as the key to recouping their investment.

To rely on seed sales alone would limit the potential use of the technology. The way around this has been to introduce technology fees. These fees are applied with every crop containing engineered genes and are independent from seed sales. These fees will be what the farmer can afford.

The farmer will be attracted to the simplicity of the system and a cost saving from less chemical use. However, most farmers fear that most of the benefits from this technology will not flow to them and they will lose the choice of what to grow if all the research is carried out on GM crops controlled by the multinationals.

Partnerships—breeding programs and the owners of GM technology

In Europe the plant breeding programs are dominated by corporate players. Australia is in a unique position with our industry controlled programs—owned by the government and collectively by growers. If GM technology takes off Australian farmers will need to have access to the technology, or we will lose our competitive edge.

To gain access to this technology we will have to form partnerships with the owners of gene technology. Having grower ownership and control of breeding programs now means that growers can influence the types of partnerships formed, so as to try to protect the long-term interests of the industry.

How will we use the technology—which is owned by corporate interests —and still retain the grower control of our breeding programs? Obviously we need a system that enables these companies to gain a return on their investment. The use of technology agreements is how Europe will progress. Is this the best system? Perhaps we should focus in Australia on developing an operational end point royalty system. This has the benefit of sharing the risk (production and price) with the farmer and at the same time enabling a large scope for returns to the technology owners.

The role and scope of regulation

Regulation is playing an increasing role in agriculture. In Europe farmers are bound by regulation for almost everything that happens on the farm. In Australia we are going to see regulations to control the commercial application of gene technology. Good regulation will help instil public confidence in farming and technology. In the short-term markets need to be protected and scientific evidence gathered. Mistakes, with bad PR repercussions, need to be minimised. As an industry we need to think how to form this regulation so that it doesn't restrict farmers in their farming practice, yet still controls the application of the science.

A lot can be learned from the mistakes in Europe. The grains industry needs to move quickly, however we now have a two-year moratorium on commercialisation in WA. This time should be used to put the framework in place for the future. GM crops will be grown in WA in the future. Too much money has been invested over the last decade for this to fail. In the longer term the world will need this technology to feed its population.

As an industry we can be excited about the future, there is potential for increased productivity and more sustainable farming practice from the application of this technology. With second generation GM crops whole new markets may open up for crops grown in Australia.

To make the most of this potential the industry needs to follow market signals, when the markets accepts this technology we need be ready to move. However, the end result of this technology will be to increase the supply of grain, which will reduce prices. Conversely, to delay commercialisation after market acceptance will put us at a competitive disadvantage. ■

Farm visits to WA

Craig Scanlan, Muresk student, cscanlan@agric.wa.gov.au

I began working at AGWEST Northam under a Tertiary Studentship in January. The studentship has allowed me to work on my Honours project while on my summer and winter (21st May–20th July 2001) break from Muresk Institute of Agriculture.

The Honours thesis title is 'The potential yield of grain sorghum in the WA agricultural region'. Part of the work I have done so far is to visit farmers who have grown warm season crops in this current season.

Some of the crops I saw were very successful, such as Neil Diamond's forage sorghum (Buntine), Jim Kirkwood's sunflowers (Kendenup) and Steve Pink's corn (Munglinup). Some of these crops have been grown on low-lying areas that range from a deep sand to loam. There were also crops that had performed poorly, which after speaking to the farmers and further reading seems to be caused by a combination of insufficient soil moisture and nutrition.

Warm Season Crops – January 2001

Left: Doc Fetherstonhaugh inspects crop variability of Steve Pink's corn at Munglinup.

Soil moisture

At Neil Young's farm in Kojonup the sunflowers were attacked by vegetable beetle, while dry soils resulted in patchy germination of grain sorghum. Machinery downtime saw these crops being planted into quickly drying soils in early October and November respectively. The dry topsoil probably has not allowed the plants to develop a vigorous root system to 'chase' moisture. The rapidly drying topsoil would also reduce the mobility of nutrients, which would have contributed to the slow rate of growth

A good example of plants developing a deep root system quickly, where adequate soil moisture is available, was a second germination of forage sorghum at Neil Diamond's property.

Neil Diamond with a recently emerged seedling.

This occurred in a higher part of the paddock that did not germinate initially in October. Three weeks after a thunderstorm in December, seedlings had roots down 20 cm into a very moist yellow loam. However, this crop was sown with knife points and was deep ripped to 25 cm, which I suspect would have aided early root development.

Nutrition

Phosphorus

Phosphorus deficiency appears to be the main symptom shown by sorghum and corn crops at all the farms I visited. Phosphorus deficiency is characterised by a red to purple coloration that is most severe at the leaf edge and diminishes toward the centre of the leaf. (Please note: Red discolouration of leaves can also be caused by some other nutrient disorders as well as moisture stress.)

Phosphorus deficiency also causes plants to appear stunted and their leaves to become thin and dark green. The lower leaves are generally the most affected. I believe this deficiency would have been exacerbated by the dry season, as all soils that I looked at had moisture at 10–15 cm, which is below the topsoil layer containing higher levels of P.

Green manured lupins in August 2000 did not release their nitrogen for the corn to use, as almost no rain fell once the lupins had died. They used much of the soil's water that would have otherwise fed this corn.

Poorly established grain sorghum is proving very drought resistant.

Evenly established corn at Neil Young's that was sown into soil with limited moisture left.

Patchy growth of grain sorghum in front left (possibly linked to better nutrition where a sheep carcass decayed). No fertiliser was drilled with this crop.

Suspected P deficiency.

The forage sorghum seedling shown above from Jim Kirkwood's is displaying what I suspect is P deficiency symptoms. Jim tells me that this paddock is low in P, and further evidence of this is shown by a group of plants in the same paddock growing where a pile of fence posts have been burnt (other nutrients are also likely to be involved).

Nitrogen

Some sorghum and corn crops also displayed nitrogen deficiency. Nitrogen deficiency is characterised by yellowing or wilting from the tip of the leaf towards its centre. Small spots of dying tissue (necrosis) along the leaf's edge can also indicate nitrogen deficiency and, as with winter cereals, a pale green colour in the leaves is a sign of N deficiency. Older leaves are affected first, and, in severe cases, younger leaves will also display deficiencies.

The difference in growth of the sorghum in the ashpile and that in the paddock is an indicator of the effect of nutritional deficiencies.

Typical discolouration associated with N deficiency.

Signs of nitrogen deficiency in Brad Wood's rattooned grain sorghum growing over 2000 sown forage sorghum.

Wheat growth is affected by Ca:Mg ratios below 0.5

Rochelle Strahan, BSc. Hons. (Soil Science and Plant Nutrition), UWA
(supervised by Professors Zed Rengel and Bob Gilkes)

The balance of soil cations (positively charged ions) has long been used as a basis for crop fertilisation among some agronomists throughout the world, and is being encouraged in WA.

Some believe that the balance between exchangeable (plant available) calcium (Ca) and magnesium (Mg) in a soil is vital (Kinsey & Walters, 1995), recommending a Ca:Mg ratio of 7:1. However, others consider this ratio irrelevant, supporting the view that fertilisation should simply aim to supply sufficient amounts of each element (Dahnke & Olson, 1991). Various studies conducted in the USA have shown that a number of plant species can produce optimum growth on soils with Ca:Mg ratios ranging from 1–16:1 (Walker *et al.*, 1955; McLean & Carbonell, 1972; McLean *et al.*, 1983). However, there has perhaps been no scientific data generated regarding the effect of the Ca:Mg ratio on the ancient, nutrient depleted soils of WA. For this reason, this UWA honours study evaluated the effect of the soil exchangeable Ca:Mg ratio on wheat growth and cation uptake in a WA soil during the year 2000.

Methods

Wheat was grown in the glasshouse for 49 days, at 7 different Ca:Mg ratios ranging from 0.2–39:1. To create these Ca:Mg ratios, samples from a Cairlocup surface soil (A horizon, north of Needilup) were saturated with Ca or Mg chlorides, then mixed in appropriate proportions. Basal nutrients were applied and it is unlikely that any Ca or Mg would have precipitated. Shoot and root yields were recorded, and Ca, Mg, potassium (K), sodium (Na), manganese (Mn), copper (Cu), zinc (Zn) and iron (Fe) concentrations were measured by atomic absorption spectrometry. The soil had a pH ($CaCl_2$) of 5.4, a clay content of 4.1% and a cation exchange capacity of 0.66 cmol/kg.

Shoot and root yields

Soil with a Ca:Mg ratio of 0.2:1 produced significantly lower shoot yields (23%) at stem elongation than soil with Ca:Mg ratios from 0.5–39:1. Root yields showed the same trend, being significantly lower for the Ca:Mg ratios 0.2–0.5:1 than for the Ca:Mg ratios 2–39:1. These results are consistent with published data for a wide range of soil types (in the USA) and plant species (Walker *et al.*, 1955; McLean & Carbonell, 1972; McLean *et al.*, 1983).

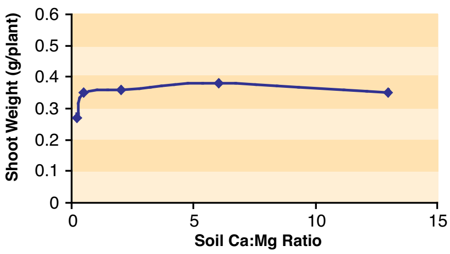

Figure 1: Shoot yield of wheat in response to increasing soil exchangeable Ca:Mg ratio.

Shoot cation concentrations

The Ca concentrations in wheat shoots increased with increasing soil exchangeable Ca:Mg ratio, while Mg concentrations decreased. These changes were most dramatic at Ca:Mg ratios below 13:1. Wheat plants grown at the Ca:Mg ratio of 0.2:1 were Ca deficient, however only 3% of the exchangeable Ca in the soil was utilised by these plants. It would be expected that with low concentrations of Ca in the soil, plants would take up a large proportion of the Ca that was available. That this did not occur indicates that the high concentration of Mg in the soil was inhibiting the uptake of Ca by the Ca deficient plants (Marschner, 1995). Similarly, high concentrations of Ca in the low Ca:Mg ratio treatments inhibited the uptake of sufficient Mg, causing Mg deficiencies in wheat grown at Ca:Mg ratios from 13–39:1.

Shoot K concentrations did not change between Ca:Mg ratios 0.5–39:1 but were significantly higher at the Ca:Mg ratio of 0.2:1. This was possibly due to the lack of Ca in the plant shoots, allowing greater uptake of K as well as Mg. Concentrations of Mn, Zn and Cu were highest at Ca:Mg ratios 0.5–2:1 but did not change significantly between the ratios 6–39:1. This indicates that these micronutrients were able to compete better against high concentrations of Mg (low Ca:Mg ratios) than high concentrations of Ca (high Ca:Mg ratios) for plant uptake. Shoot concentrations of Fe were unaffected by increases in the soil exchangeable Ca:Mg ratio.

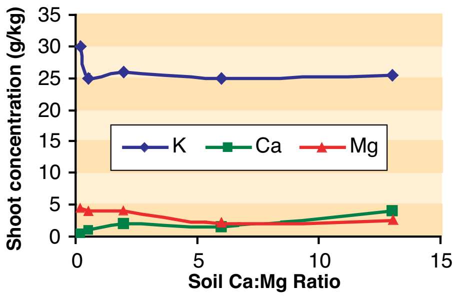

Figure 2: K, Ca and Mg concentrations in wheat shoots with increasing soil exchangeable Ca:Mg ratio.

Implications for WA farmers

Given that these results were generated in controlled glasshouse conditions (closed pots), it is difficult to make strong conclusions for field situations. In the field, plants have access to soil at a range of depths where Ca:Mg ratios may change and soil pH, water and temperature conditions would vary. However, these results still show that, as the proportions of soil Ca or Mg taken up by Ca or Mg deficient plants were very low, it is likely that the Ca:Mg ratio was the limiting factor for plant growth. Therefore, lime addition to increase the soil Ca:Mg ratio may be useful in increasing wheat growth—but only if the original ratio is less than 0.5:1, which is not common in WA soils. Also, if lime addition increases soil pH above 6.5, overliming problems such as micronutrient deficiencies and poor lupin growth (Gazey, 1999) may be encountered.

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Careful management of wheat stubble helps canola growth

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The beneficial effects of reduced tillage and retained crop residues for erosion control and soil structure are well known. However, adoption of these practices is being limited by problems with poor crop establishment and growth.

In particular, poor early growth of canola crops sown into retained wheat stubble is widely observed. The problems may be due to:

1) nitrogen tie-up
2) temperature differences induced by the stubble
3) insect damage
4) disease
5) toxins leached from the stubble.

This article reports results from preliminary field studies investigating the likely causes.

Materials and methods

A field site on Holland's farm at Greenethorpe (Central NSW) that contained 6 t/ha of Rosella wheatstubble was harrowed and Pinnacle canola was direct drilled at 25 mm depth. MAP fertiliser was drilled at 110 kg/ha at seeding, 40% was placed with the seed and 60% was banded with 120 kg/ha of urea at 10 cm depth.

Four stubble treatments were established:

1) a cool burn immediately before sowing (**Burnt**)
2) stubble raked off plots (**Bare**)
3) stubble raked onto the inter-row ridges (a mimic of the farmer's sowing technique) (**Ridges**)
4) retained stubble spread evenly across the top of the plot (mimicking the use of a prickle chain) (**Top**).

The following data were collected:

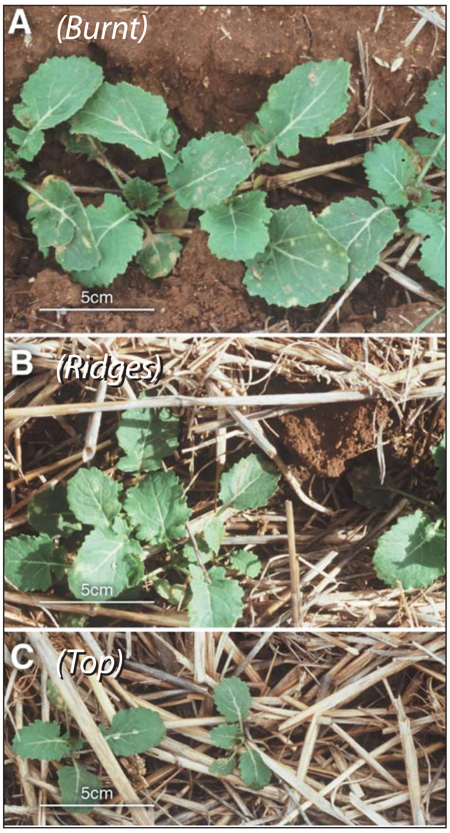
1) seedling emergence counts
2) counts of insect damage on first leaves
3) plant nitrogen content,
4) seedling characteristics
5) temperature and light
6) biomass and yield measures.

Results

Seedling emergence was inhibited in the presence of stubble—see adjacent graph. Nine days after sowing, the Top treatment and Ridges treatments had an 81% and 46% reduction in seedling density, compared to the Burnt treatment. Fifty-two days after sowing the Top treatment still had a 50% reduction in seedling density compared to the Burnt treatment, while Ridges was not significantly different to Burnt.

Seeder used to plant the canola.

Nine days after sowing (see table next page) the seedlings in the Top treatment showed a five-fold increase in insect damage, a 30% decrease in leaf number, a 32% increase in hypocotyl length*, a 38% decrease in shoot dry weight and no difference in shoot nitrogen concentration compared to the burnt treatment. Other treatments were between these extremes. Shoot nitrogen, three months after sowing, did not differ between the treatments.



Plant emergence through varying wheat stubble treatments.

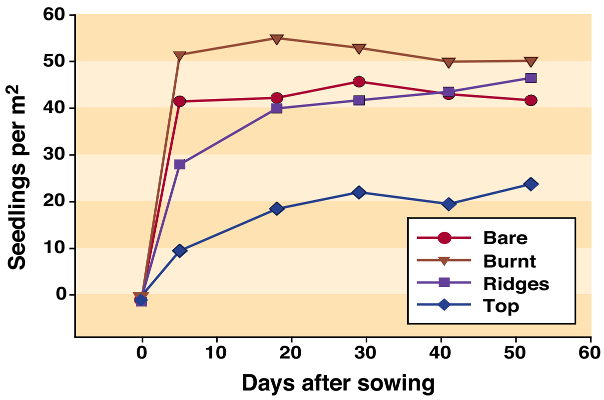
Three months after sowing, at stem elongation, the Bare and Burnt treatment had three times the biomass of the Top treatment (see graph next page). By the middle of September, at flowering, the differences in biomass were less marked. The Top treatment, however, still had lower biomass than the Burnt and Bare treatments. Note that the Ridges treatment was intermediate in biomass at both times.

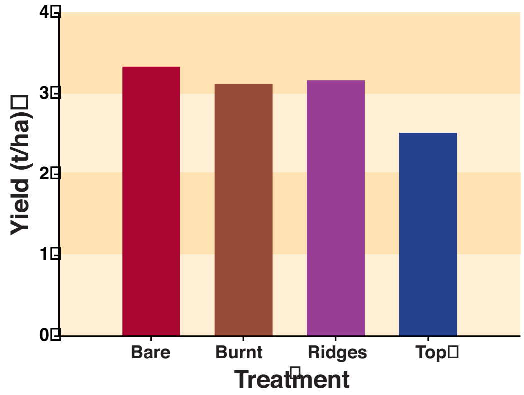
At harvest, the Top treatment had suffered a 25% reduction in yield compared to the other treatments, while the Ridges treatment had the same yield as the Burnt treatment. Harvest index was identical in all treatments. Oil content was lower by 1% in the Top treatment than the other treatments.

Conclusions

The presence of stubble led to reduced emergence compared to the Burnt and Bare treatments, especially when stubble was raked across the seeding rows (Top). This reduced emergence was correlated with an increase in insect damage, an increase in hypocotyl length, a reduction in leaf number and a reduction in shoot dry weight. Longer hypocotyls may be a response to the physical burden of the stubble layer, and may cause the reduction in leaf number due to increased energy reserves being utilised for hypocotyl production. In some instances, there may be insufficient energy reserves for leaf production, leading to seedling death.

Nitrogen tie-up is often implicated as a factor contributing to a reduced growth under crop stubbles. However, our results show no difference in shoot nitrogen between the different treatments indicating that nitrogen tie-up is not contributing to the reduced growth of canola under wheat stubble, given normal nitrogen fertiliser application levels. Other factors under investigation that may also contribute to the reduction in emergence include the leaching of toxins from decomposing stubble and lower temperatures at the surface of the stubble.





Treatment	Insect damage (%)	Leaf number	Hypocotyl length* (mm)	Shoot nitrogen (%)	Shoot dry weight (mg)
Burnt	6	2.0	44	6.1	16
Bare	9	1.9	43	6.0	16
Ridges	19	2.1	47	6.2	15
Top	32	1.4	64	6.1	10

* Length of stem between roots and first leaves.

The Ridges treatment was generally intermediate between the Burnt and Bare treatments and the Top treatment. Whilst seedling emergence was initially delayed, final yield was similar to the Burnt and Bare treatments.

The major implication for management in stubble retention systems is that sowing techniques that push wheat stubble away from the seeding row may eliminate the negative impacts of stubble on the growth of canola seedlings.

Before sowing, aim to harrow the paddock to break up the stubble and "fluff" it up. When sowing, use tines that push the stubble away from the seedling row and a press wheel to improve seed–soil contact (a prickle chain will evenly spread the stubble across the seeding row).

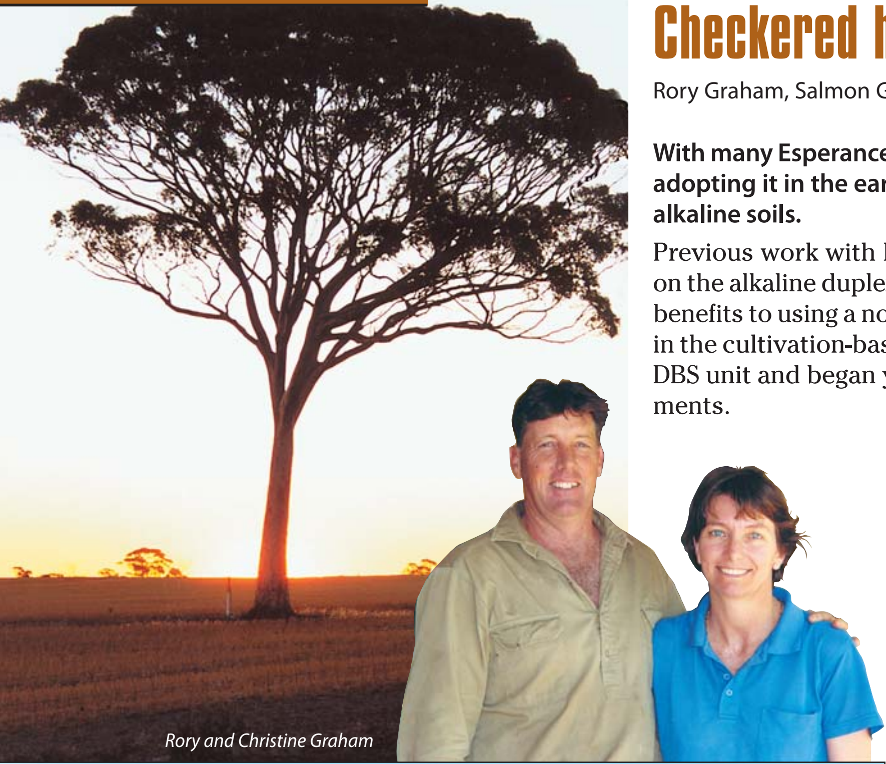
This should provide both adequate seedling emergence and growth and enable the beneficial aspects of stubble retention to be retained. However, note that burning stubble may be necessary for example when high numbers of slugs are expected, or problems with weed or disease control become apparent.

Checkered history of no-till at Gorya Valley

Rory Graham, Salmon Gums (08) 9078 5013

With many Esperance sandplain farmers getting excited about no-tillage and adopting it in the early 1990s I thought I should do my own trial work on my alkaline soils.

Previous work with less tillage often did not give good results—especially on the alkaline duplex sandy-surfaced soils. I could see there would be many benefits to using a no-tillage system—as long as the yields could equal those in the cultivation-based systems. Therefore, in 1994, we bought an Ausplow DBS unit and began years of trials. This is an overview of my tillage experiments.



Rory and Christine Graham

Prior to starting my research we had many vigorous and healthy discussions about no-tillage with local farmer celebrity, and respected farmer, Roger Fletcher. He maintained that many trials over the years have shown that no-till fails in the Gums.

The first year of the trials (1994) was a drought. However, we compared tillage techniques on several paddocks. The 'Brown' paddock yielded 1.25 t/ha of wheat with conventional tillage, while cultivating then Ausplow seeding gave 1.27 t/ha, and no-tilling gave 1.11 t/ha.

Also in 1994, we compared a range of seeders and replicated it twice. The autumn cultivation treatments performed best, but the Great Plains zero-till treatment also performed well (see table below). Perhaps this was due to the extra weed control achieved by applying SpraySeed after seeding. This was applied safely—due to the uniform crop emergence.

Then in 1995, in the 'Eldreds section' (3 paddocks) on pea stubble, the Ausplow yielded twice that of the direct drilled treatment. The Burke paddock, cultivated in autumn and sown in late May with the direct drill (full cut–Alfarm bar), gave nearly twice the yield of the no-till (0.7 vs 0.3 t/ha). We had similar poor yields and tillage results in the 'Dog Leg' paddock. The 'Home paddock' was worked dry in April for a tractor demo and sown with a full cut. It yielded 0.80 t/ha, while direct drilling gave 0.63 t/ha. There seemed to be a reduction in *Pratylenchus* with the dry working.

Good stubble shows yield potential that is often not realised at the Gums.

Right: The Fletchers inspect a zinc by tillage trial in their cow paddock—it failed! These plots contained the first measured high levels of root lesion nematode (RLN or Pratylenchus). The trial was managed by Brad Peters and Dr Gordon MacNish in 1994.

Below: Colin 1994 replicated strip results

Tillage used	Crop yield (%)
Scarify (March and May) full cut seed	100
Great Plains zero-till (SpraySeed IAS)	100
Plough (May) and full-cut seed	99
Scarify (May) and Ausplow seed	97
DD full-cut Alfarm bar	82
No-till Ausplow	76
No-till ConservaPak (12" spacing)	75

Widespread crop ill-thrift was originally thought to be due to rhizoctonia. Later it was shown to also host high levels of Pratylenchus.

Rory has both tillage and no-tillage seeders ready for use.

During 1995, while with AGWEST, Bill Crabtree supervised a tillage trial that surprised us all. The table immediately below shows the results. The double disc openers (with press wheels) performed best, out-yielding the conventional and the modified combine sowing by 12% and 14%. Less moisture was probably lost from the undisturbed soil. The knife-points also yielded well.

Machine used	Wheat counts (p/m2)	Dry matter (t/ha)	Grain yield (t/ha)	Screenings <2.0mm
Great Plains	187	0.62	0.91	3.9
Direct drill (5" points)	165	0.70	0.86	3.8
No-till (Harrington)	173	0.77	0.85	3.1
Great Plains plus wavy coulter	164	0.69	0.83	3.7
Full cut seed after cultivation	180	0.78	0.82	3.2
Modified combine (2" points)	179	0.80	0.80	3.4
LSD at 5%	ns	0.08	0.10	ns

1995 AGWEST trial at Rory's farm—the plants show drought stress—notice the edge effect!

Year	Crop	Cultivate	Protein	No-till	Growing season rainfall (mm), Avg = 190 mm	
1992	Peas	0.65			305	Wet year, wireweed and black spot
1993	Wheat	2.60	12.4		136	Moist—seeding early
1994	Barley	0.90	16.0		131	Very dry seed—late May (157mm total]
1995	Pasture				171	
1996	Wheat	1.56	12.0	1.00	218	Very dry seed—12 June break
1997	Peas	1.20		1.20	223	Mid-May start then got wet
1998	Wheat	1.75	9.1	1.75	181	Patchy moisture at seeding
1999	Barley	3.00	10.5	2.50	172	Very marginal, moist at seeding (until July)
2000	Pasture					

'Helicopter' paddock trial.

In 1998, in the 'Heli middle' paddock, both the no-till and minimum tillage (work once, then sow) yielded 1.75 t/ha. In the 'Gooseneck' and 'Ridge' paddocks the no-till yielded 20–40% more than the minimum tillage adjoining paddocks (2.1 vs 1.4–1.8 t/ha). Frost, nutrition and diseases were all observed factors, so it is hard to make strong conclusions here.

In 1999, there were large differences between tillage treatments. On most occasions the no-tillage was a long way behind (about 30%), while in some early no-tilled paddocks the yields were respectable [(2.2 t/ha).

During the last five years I have split the 'Helicopter' paddock in half and managed it with two tillage levels. The east half is no-tilled while the west is cultivated 1–2 times before seeding. Note that the no-tilled half has achieved either less or sometimes equal the grain yield of the tillage-based half of the paddock.

Summary

I would like nothing better than for no-tillage to give reliable yields on my farm. However, my research has shown that no-tilled crops consistently yield less than those in cultivated soils. I plan to keep experimenting with rotations and tillage and hope that we can learn what we need to do to get consistent good yields from no-tillage.

(Editor: Rory farms in the one area of the state where no-tillage struggles to perform, particularly on his sandy alkaline duplex soils. This has been observed in other regions of the world, including South Australia and South Africa. Obviously diverse crop rotations of some sort would greatly help to remove the biological constraint that is working in these soils. WANTFA is open to any suggestions here!)

Excellent warm season crop results after wet summer

Owen Brownley (Committee member),
Lake King (08) 9838 0010, fax 15

In the spring of 1999 we sowed five different warm season crops in small blocks of 0.6–5.0 ha alongside each other on our southern wheatbelt farm. The crops grown were corn, grain sorghum, forage sorghum, millet and sunflowers. These were sown in mid-September into a flowering and then desiccated pea crop, alongside healthy peas that continued to grow.

Grain sorghum and forage sorghum grew well in the wet summer of 1999–2000 at Lake King.

To seed the crops I used a 9m Great Plains Disc Seeder with coulters in front of seeding discs and a Simplicity air seeder tank towed behind. The row spacings were 760 mm on one side of the machine and 152 cm by 76 cm skip rows on the other side. When travelling up and back this resulted in 5 skip rows and 11 wide rows.

Fertiliser was 15 units of P and 60 units of N per hectare. A small amount of each was drilled with the seed and the remainder (the bulk) was banded 190 mm either side of the seed rows with the double discs. Corn roots had reached the side-banded fertiliser by the 3-leaf stage (see photo below). Insects are believed to have given a poor establishment of sunflowers and the grain sorghum was also a bit thin but the other crops established well.

3 leaf corn grows aggressively, searching for nutrients in the band 18 cm away where the double disc placed most of the N and P.

Corn grows aggressively, achieving 4 t/ha, but was greatly stunted where plants were too closely spaced.

Because corn was not planted with a precision seeder, the plant spacing was uneven and where a number of plants were close together, there were small cobs and some stunted yellowish-looking plants.

There was a lot of summer rain (250 mm). Most of this was in mid-January and gave exceptional growth to the summer crops.

Shirohie millet grows well on these wide rows and good fertiliser regime.

The tall forage sorghum was rolled and this enabled ease of seeding with the wheat. However, seeding with the disc seeder needed to be in the direction of the rolling. Interestingly, in January 2001, most of this sorghum has ratooned and is 0.5 m high.

The corn reached 2 m high, the forage sorghum 3 m high and the millet 1.5 m high. The corn yielded 4 t/ha at about $200/t, the grain sorghum 1.3 t/ha, and the millet 1.6 t/ha. The Jumbo forage sorghum wasn't grazed but was rolled flat with a pea roller before seeding into its residue. The sunflowers were too thin to harvest.

Warm season crops used a lot of the stored summer moisture that would otherwise have been available to typical winter crops

The corn and grain sorghum were harvested in late-March with a MacDon Draper front. The millet was swathed and then harvested with a pick up front. Weed control was very good in the well-grown or bulky crops (corn, forage sorghum and the millet). There were almost no weeds in these thick crops and no summer knockdowns were used in these crops, except 2 L/ha of glyphosate in the grain sorghum to encourage grain maturation in mid-March.

The thinner grain sorghum and sunflowers had a lot of weeds due to less competition and these crops required two knockdown sprays during summer and autumn.

The surrounding pea stubble had four knockdown sprays prior to seeding due to the wet summer, whereas the forage sorghum, corn and millet had one spray. Grain sorghum and sunflowers required two sprays. More weeds survived in skip rows than narrow rows.

Last year, wheat was sown across all plots and the adjoining pea stubble with 72 kg/ha of Summit No-Till and 60 kg/ha of urea applied IBS. As we know, 2000 was a very dry growing season and these warm season crops used a lot of the stored summer moisture that would have been available to the typically grown winter crops. When compared to the wheat grown on the pea stubble, wheat grain yield losses from these warm season crops ranged from 0.3–1.3 t/ha.

Observations suggest that the more bulk or growth of the warm season crop, the weaker the wheat was in both growth and colour. The corn was a slight exception to this rule. Wheat on sunflower stubble yielded the best because of the very poor sunflower establishment and growth.

The wheat yields from the 2000 season, in t/ha, after warm season crops were: 0.93 after corn, 0.83 after grain sorghum, 0.48 after forage sorghum, 0.64 after millet, 1.47 after sunflower and 1.75 t/ha after field pea.

The results

These results show that the corn was very profitable. In the spring just gone, the soil conditions were too dry to contemplate sowing these crops, which we had planned to do—therefore the seed is still in the shed.

Wheat grows well on pea stubble (top right) compared to the nutrient and moisture limited wheat growing on sorghum stubble (lower left) during the dry 2000.

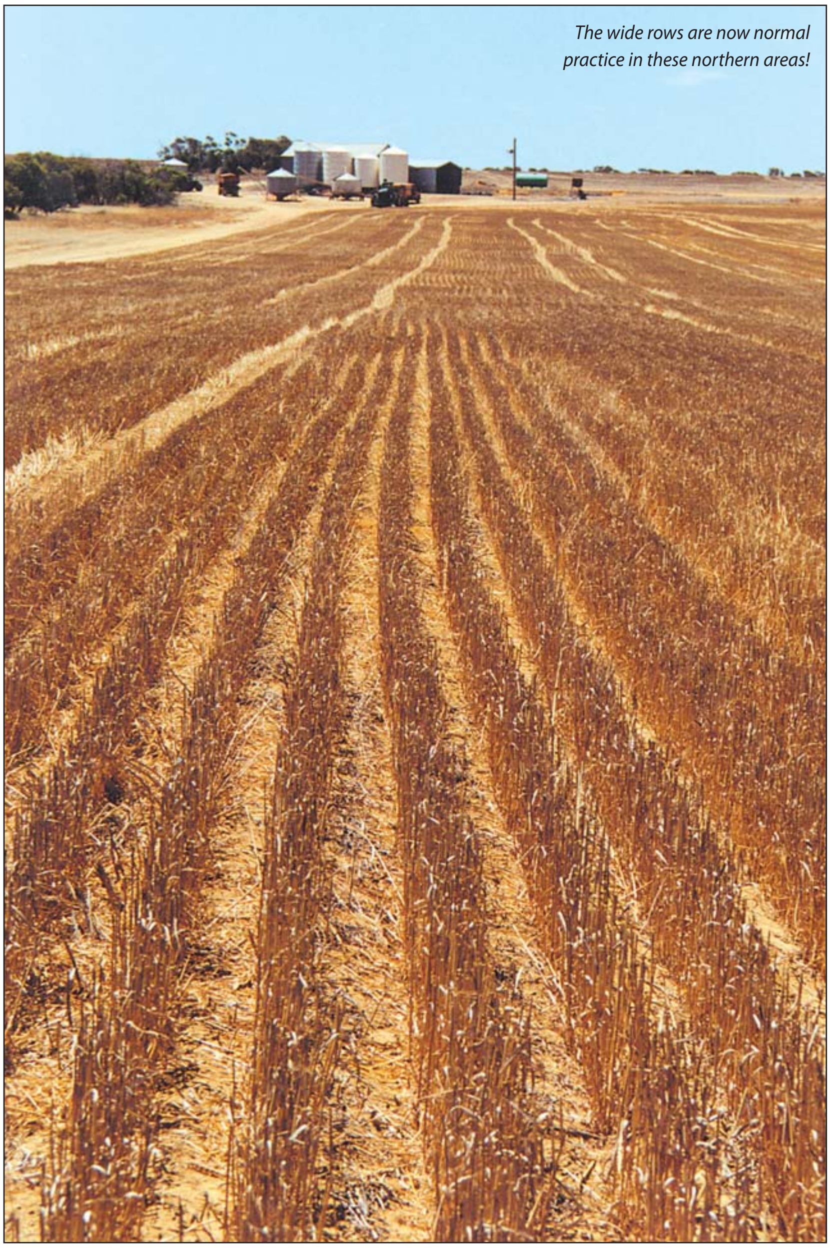
Early wheat grows well through thick rolled forage sorghum.

Mick now uses the DBS seeder to help him chase the moisture—a seeder well designed to do so!

A history of no-till agronomy at Tenindewa

Mick Desmond, Tenindewa (08) 9962 5054, fax 70

Along with my wife Juanita and my parents, Alan and Glenys, we farm in both the M1 (northern medium rainfall region) and recently also in the L1 zones (1,100 ha). Our home farm is situated in the Tenindewa area, about 70 km east of Geraldton.



The wide rows are now normal practice in these northern areas!

It consists of 3,000 ha of arable land, comprised of Eradu sandplain and about 10% red sandy loam. I have been invited to give a history of our adoption of no-tillage in this northern agricultural region.

We first started using narrow points and furrow sowing in 1991 on our red sandy loams. Before this we used minimum tillage, with a knockdown, seeding and a deep rip after seeding to stop wind erosion.

Chasing moisture and finding deficiencies!

In 1994, in the lupin phase, we took our row spacings out to 25 cm and with a fusion airseeder placed 150 kg/ha of super, copper, molybdenum and zinc down the tube, thereby getting the trace elements where we thought they should be. In our soil, which had become non-wetting in the top few inches, the narrow points, which we called emu toes (5 cm wide and worked 7–10 cm deep), left a furrow 7 cm deep. This was a winner with our best germination in a long time. However, this did not show up with a yield bonus. A combination of ester toxicity from spraying summer weeds and a poor finish to the season resulted in low yields, but the good crop emergence was enough to encourage us to continue with these points.

Our fertiliser placement theories and the fact we were grading the nutrients away from the plants became reality in the wheat crop of that year. Sadly, we watched our healthy wheat crop emerge well and then slowly retreat back with chronic zinc and copper deficiency. As a new leaf emerged, the leaf before it would die, which made it difficult to get much foliar-applied trace elements into such a sick plant. Hence we lost at least 2 weeks of crop growth in such a short year just trying to eliminate a trace element deficiency.

The next few years we tried sowing into marginal moisture with homemade speed boots angled down behind the point at 6–7 kph. The result was some successes and some failures. Deep ripping was being done before seeding, as the furrows at seeding were so large that the wheat could not emerge from such a depth after the deep ripper had levelled the furrows. The target seeding date was now early May and a timely in-crop spraying of grass weeds in the lupins made brome less competitive, as the crops were able to emerge a week before the grass and shade it out. Sometimes this was not the case and on two occasions we left paddocks out to be spray topped, followed by lupins for a second grass knockdown. But this was pre-ryegrass days!

Going wider!

At the end of 1996 we were not too happy with our seeder. We had built a spray truck to deal with the deep ripping, which was leaving 150 mm gutters as well as chaser bin and header marks everywhere. We bought DBS modules that individually followed the ground, and fitted them to a trashworker at 1 foot spacing. This was the cheapest option as it avoided the expense of a new seeder bar. We agonised over wide rows, but after more reading of AGWEST research, we realised that when coupled with deep ripping the yield loss (from wide rows) was likely to be minimised—so we took the punt. We also were able to increase our seeding speed to 9 kph.

From 1997–2000, except for one year, there has been an opportunity to chase subsoil moisture at seeding. Usually, at 10 cm below the soil surface, there is moisture that will allow germination. With the wide rows we are able to grade a deeper furrow. Deep ripping on summer rain also assists this by providing aeration, mineralisation and moisture conservation. Since 1984, the package of stubble retention spraying weeds out early (something we failed to do in 2000) and diversifying rotations seems to have improved our chance of seeding early. This allows grain fill to occur before the soil warms and dries out in spring.

Canola is part of the system

Rotations play a big part in determining the potential of the wheat crop, as we cannot grow wheat-on-wheat on our sandy soils. Although we have not made much money directly out of canola, the rotational benefits of canola to the wheat crop and the disease break of brown spot in lupins, has led to canola still being planted on roughly a quarter of the area of the home farm. We grew lupins for many years before we got an average return out of them, so hopefully in years to come, we might also get a reliable cash return from canola also, as well as the rotational benefits.

The remainder of our cropping land is in the L1 region and consists of shallow limestone ridges, sandy loams and heavy clay. We have only cropped this country for two seasons and are still very much feeling our way. We have grown some healthy stubbles even in 2000, but these crops were frosted. We either take chances with frost sowing early or a dry finish sowing late. The challenges of farming!

Please encourage others to join WANTFA

Western Australian No-Tillage Farmers Association (Inc)

WANTFA is a high yield sustainable farmer group who believes in the enormous systems benefits of no-tillage, stubble retention and diversity of crop rotations. We exist to encourage research and as a medium for farmers worldwide to share knowledge of complex systems issues. WANTFA pushes for more sustainable and productive cropping systems and acknowledges that, in some situations, tillage can be a useful tool.

Sharing knowledge

The main WANTFA products are:

- Four full colour newsletters per year.
- The Annual WANTFA Conference(s).
- Meckering large scale trial site and field day (Diamond Sponsors—GRDC, CSBP futurefarm, Commonwealth Bank and AGWEST).
- Various regional field days and specific seminars which are important meetings for members.
- Assisting visits by overseas and interstate no-till specialists and farmers.
- Study tours to all regions of the world (this year South America).
- WANTFA's website.

Human Resources

WANTFA employs two Scientific Officers with assistance from GRDC and AGWEST (through the Minister for Primary Industry and Fisheries) who are based in Northam. WANTFA also contracts John Duff & Associates to provide Administration and Management Services.

Strength in numbers

WANTFA is run by a voluntary farmer committee with representation from all regions of the state. The committee is becoming increasingly significant in agricultural agronomic issues within Western Australia. Membership is currently near 1,300. It is our desire to be useful to other groups—especially locally driven agronomic and sustainability groups.

We would be honoured if you would encourage others to join WANTFA. To do so, they would need to fill in the attached application form or contact WANTFA Administration, 08 9277 9922, fax 08 9475 0322, Suite 5, 110 Robinson Ave, Belmont, 6104, WA. An application form can be found at www.wantfa.com.au.

Please indicate your choice of option listed below.

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