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Western Australian No-Tillage Farmers Association (Inc)
Newsletter
SUSTAINABLE AND HIGH PRODUCTION AGRICULTURE – NOW!
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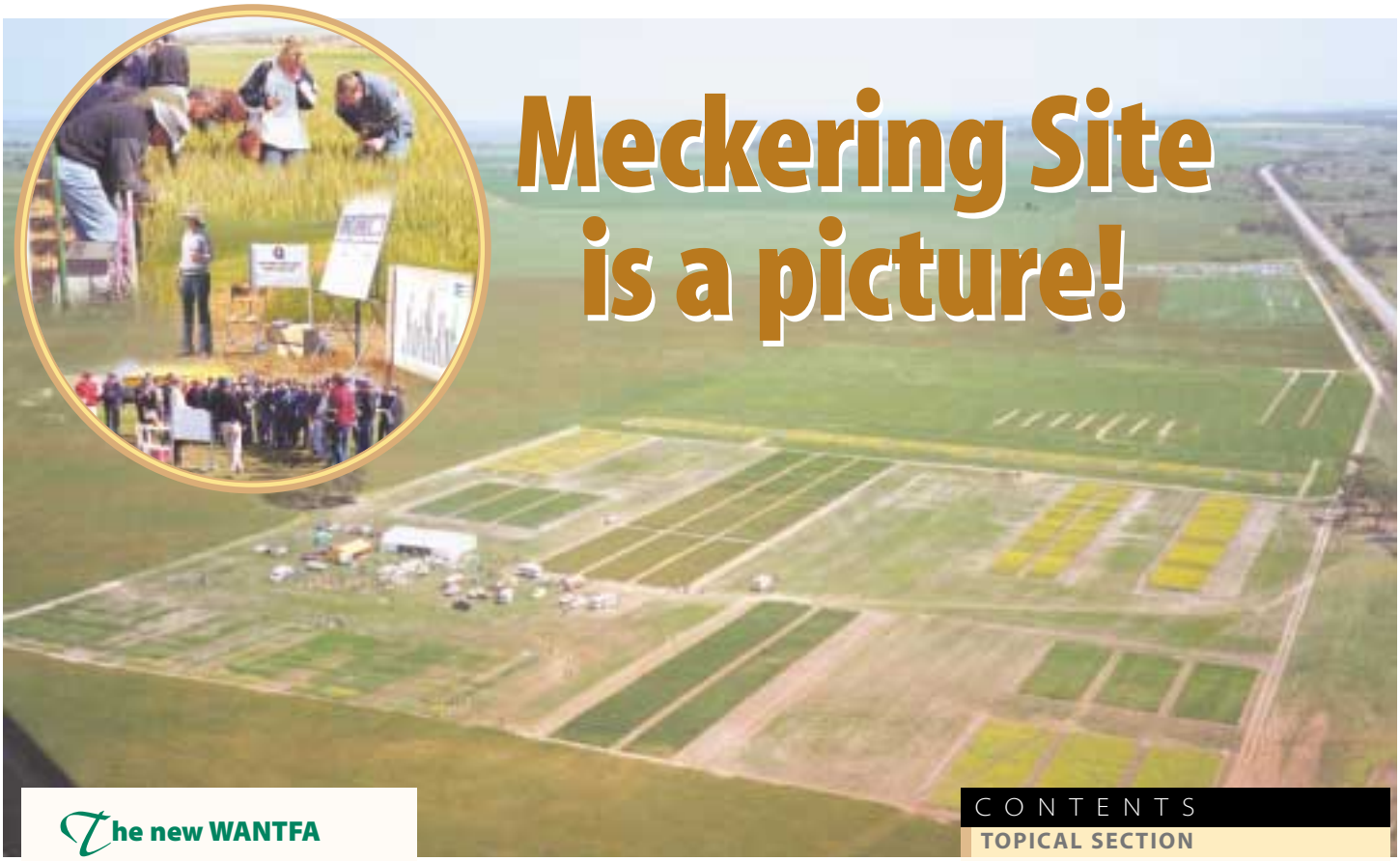

Meckering Site is a picture!

The new WANTFA Meckering R&D site has about 20 visually impressive trials for all to see on the Great Eastern Hwy, 4 km west of Meckering. We had an excellent Field Day with 350 people attending the day on 18th September.

The written feedback has been very positive. If you missed that day, then you are welcome to walk the site yourself or, arrange a busload and I will take you over the site (for a fee) or attend the pre-harvest field walk on Thursday 26th October.

WANTFA is thankful to GRDC, CSBP futurefarm, the Commonwealth Bank and AGWEST for their large financial support. Thanks also to other groups who sponsored the trials (Aventis Crop Science, 4 Farmers, Nufarm, Valaw Pty. Ltd, AgLime and the Hollett Brothers). ■

CONTENTS

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Bill Crabtree, WANTFA's Scientific Officer is funded by:

Melons love no competition after summer rain.

Melons—nature's way!

At Mingenew, in July, I noticed melons everywhere. And just how useful are they to the farming system? It made me think of Alan Savory's quote that Dwayne Beck used at our conference, being "weeds are natures way of adding diversity to a system that lacks it".

The melons grew because there was no other plants there to use the water! This is why it makes sense to trial warm season crops. On Ashley Jones' farm 30 km north of Dowerin, right at this moment, WANTFA is planting a whole range of warm season crops. Thanks to NHT and AGWEST for their support in this R&D work.

Radish love tillage!

Richard McKenna, WANTFA committee member at Mullewa, noticed this year how undisturbed radishes don't like to germinate. His father noticed the same thing 50 years earlier—see *WANTFA Newsletter* November 1999! It is interesting that South Americans say the same thing—time and time again—no matter which of the four countries I recently visited (Brazil, Paraguay, Chile and Argentina). However, they have universally adopted disc seeders and diverse rotations, with cover crops.

It is interesting that the RIM (Ryegrass Integrated Management) model developed by the University of WA and other work from Merredin suggests that tillage is essential in this chemical age to control resistant weeds.

Richard showed me how only a few radish germinated (left) where the lupins were not sown after knockdown compared to where the lupins were sown with knifepoints (right).

This contradicts south coast farmers' experience with ryegrass (see Ben Hatter's article in this *Newsletter* and Richard's observation here).

May I suggest that weed researchers need to generate data about weeds and zero tillage with discs (without soil throw) on ryegrass and radish, in preference to saying that an autumn tickle makes a lot of sense or that tillage is needed for weed control in models. The South Americans have 15 years of experience with zero-tillage and are confident that tillage causes weed problems.

Weeds steal crop moisture

Once again in WA's dry regions, weeds that were not sprayed out after a summer rain have stolen crop yield potential. North of Mukinbudin at Morine Rock, Luke Sprig could clearly see where he missed with glyphosate on a half-hectare patch—where he has probably halved his yield.

The foreground patch had capeweed growing until not long before seeding—this dried the soil.

Luke has clearly seen the benefits of his no-till program in yet another dry year on the edge of pastoral country.

Flexi-N can be too hot!

New users of Flexi-N (urea ammonium nitrate) are learning that 100% Flexi-N can burn the crop. In the photo shown, Trevor Fowler put neat Flexi-N out with 2,4-D Ester and the swirling action behind the sprayer probably caused the burning on the wheat. This suggests there would be benefits for using sprayers with high clearance and suggests that diluting Flexi-N makes sense. See some excellent results of Flexi-N at WANTFA's Meckering site.

Trevor Fowler's Flexi-N only burnt the crop behind the sprayer.

Header rows are back

Once again throughout the wheatbelt the 'wave effect' of header rows has occurred again. Some measurements from Caixian Tang and Mark Whitten (UWA Soil Science, tel: 9380 2503) have shown that pH changes in the burnt header rows can be up to nearly a whole unit more, thus confirming Bill Bowden's results discussed (though not presented) in the last *Newsletter*. An increased pH can alleviate aluminium toxicity and improve the uptake of many other nutrients. ■

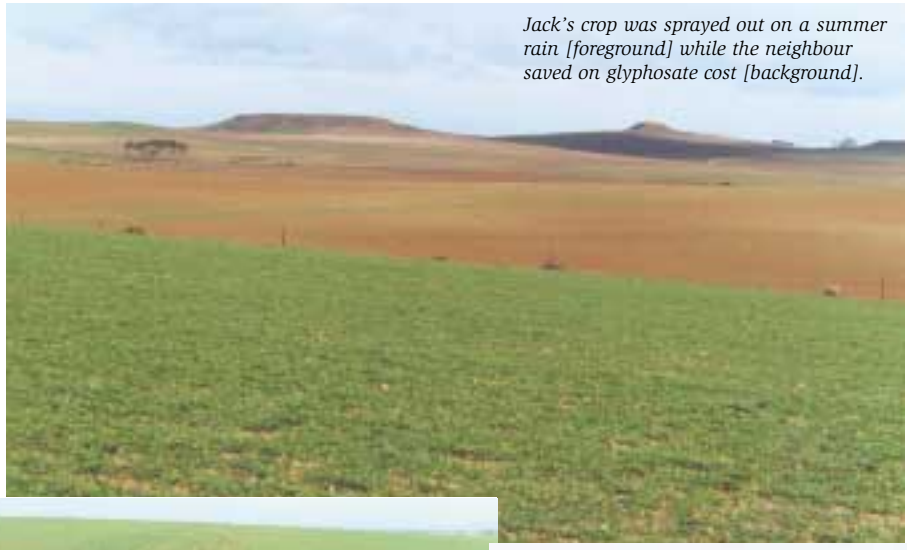
Header rows can be clearly seen at Hyden.

South African gets same results

In late May 2000 I visited a pioneer no-till farmer, Jack Human from Hieldelburg (300 km east of Cape Town). Jack has been a lonely no-tiller for many years. Now, however, others are seeing the benefits that Jack has been quietly observing for a long time and are keen to learn. Jack's climate and soils are very similar to ours.

Many years ago Jack made a tungsten tip knifepoint that is similar to the Harrington point in angle, shape and size (without ever seeing the Harrington model). Jack primarily grows wheat, lucerne, barley and canola.

This year, one of Jack's neighbours did not adopt the whole no-till package and found his paddock too dry at seeding. ■



Jack's crop was sprayed out on a summer rain [foreground] while the neighbour saved on glyphosate cost [background].

▶ *Centre area is where Jack missed some Doublegee with his boom and dried the soil out in March–April.*

▶▶ *Jack Human (centre right) explains to Eben Jansen (who visited WA with 14 farmers recently) how his no-till package works.*

The Min Till Drill

If you would like drill on Min Till (cropping systems) then the Kondinin Group have just released a comprehensive and useful publication. The publication covers a wide range of subjects within the range of minimum tillage cropping systems, including reduced tillage and direct drilling, no-tillage, and zero tillage. A large, well illustrated book, it will cost about $88 (inc. GST).

Kondinin Group members will receive a discount. Call them on (08) 9478 3343. ■

Should we plough every 5–7 years?

It seems wisdom to suggest so—like "when on a good thing—don't stick to it!". However, the more I travel and the more leading farmers I meet anywhere the message seems more like "a good marriage just keeps getting better and better with time".

The first flush of nitrogen from tillage after many years of no-till may give exciting crop growth benefits but the excitement soon wears off. Eating away at the soil's assets and undoing long-term improvements does not seem prudent to me or to the leading farmers I meet. To say that green manuring or ploughing adds healthy diversity to farming does not do justice to the complexity of things that are changed by the process. ■

Are Great Plains feeble?

Several people have told me that Great Plains are feeble and don't last. I don't think this is true, and nor does WANTFA committee person Ric Swarbrick from Gairdner, unless it is engaged while turning corners. Many seeders, disc or knife, will last longer and benefit from seeding up and back or lifting on the headlands. ■

Claying produces results at Esperance

There are many farmers breathing a sigh of relief in Esperance this year as high rates of clay have really made crops grow well on otherwise poor water-repellent soils. Ross Whittal is one farmer who did not hold back from the high clay rates. Ross's poor results from low rates (50–100 t/ha) applied several years ago has him convinced that Clem Obst from South Australia was right when he said "put lots on and mix it in properly".

WANTFA, in conjunction with others, has four large scientifically robust claying trials located around the state. These trials are testing 0, 50, 100, 200 and 300 t/ha of subsoil (containing 30–38% clay) mixed into the soil at two levels—low and high intensity.

Our trials—with many partners—are located at:

- Dalyup (Esperance)—thanks Luberda's, Esperance Laser Levelling, Mitchell Agco, CSBP futurefarm and AGWEST
- Brookton—thanks Hall's, Walter Den Engelson and Lake Mears TopCrop group
- Meckering—thanks Pearse's, Walter Den Engelson and CBA, CSBP, AGWEST and GRDC
- Agaton Catchment (Dandaragan)—thanks Kennan's, John Reid and Rob Hetherington (AGWEST) and Dandaragan LCDC.

High rate caution! Be aware that high rates of good clay subsoil (containing >50% clay) can cause serious sealing problems. With more than 250 t/ha of subsoil clay that has more than 45% clay is likely to cause sealing problems. This can be costly. It is hard to mix so much clay into the top 20 cm—which is probably the depth needed to avoid sealing. This type of clay, when ripped, comes up in clumps and kneads out to 6–10 cm length when massaged. ■

◀ *Esperance claying trial sign—smaller signs will be on the fence.*

▼ *Esperance site—lupins struggle through no clay (right) and 300 t/ha (left) of clay.*

Ross Whittall's canola after claying this year.
Insets: Same paddock earlier this year after 300–380 t/ha of subsoil had been applied.

Conference 2001

Chilean and passionate about the benefits of stubble retention and no-till is Carlos Crovetto. Carlos will be a keynote speaker at our Annual WANTFA Conference, along with dynamic and innovative NSW farmer Scott McCalman, who spoke at our warm season crop seminars recently. The conference dates will be:

- **Friday 23rd Feb, Esperance Civic Centre.**
- **Monday 26th Feb, Geraldton Queens Park Theatre.**
- **Wednesday 28th Feb–Thursday 1st March in Perth.**

Carlos Crovetto will be a keynote speaker at our 2001 Annual Conference.

For about 300 years tillage-based agriculture has destroyed many hilly soils in Chile. So when Carlos learnt about no-tillage about 20 years ago, he adopted it readily. Carlos is now the President of the No-Tillage Farmers Association in Chile and he has published a full colour book loaded with useful information called *Stubble over the Soil*. The book is available from The Rural Store in Victoria for about $83. There is a discount for WANTFA members—ask for Jim Lowden. ■

Carlos's had 700 farming neighbours—now he is almost the only one left.
Most were beaten by water erosion and have sold out to trees (bluegums and pines).

Raised beds lift yields

Once again the raised beds along the south coast and elsewhere have proven their worth to those who own them. See the last *WANTFA Newsletter* (May 2000) for a comprehensive review of three farmers' experiences and the AGWEST data generated. There is discussion that the extra water movement off the beds might be increasing run-off into nearby water systems and paddocks—this obviously needs to be managed sensitively. ■

Esperance crops saved from waterlogging by raising beds.

Water effectively moving off of Harvey Morrell's paddock at Beverly.

President's Report

Geoffrey Marshall, Hyden (08) 9880 0038, fax 18

No-till and stubble retained systems work

This is a statement that most farmers in this state should agree with for the year 2000. Significant January rains, followed by limited rain until June, enabled no-till farmers who sprayed weeds out in autumn—a seeding opportunity when it would otherwise have been too dry! This approach does have some herbicide cost. To compare at harvest the results of early and late established crops will be a savage reminder of the generally harsh climate that we have, with major variations from year to year.

This system was tested at least twice, with major wind events this seeding, and it is despairing watching non-replaceable soil moving off paddocks.

Meckering R&D Site

This is a very visual site with lots of excellent no-till research being conducted. For those who missed the 18th September Field Day—there will be a pre-harvest field walk on Thursday 26th October at 9.00 am with the sub-committee in the last week of October. Individuals are welcome to visit the site, while groups will be charged a small fee and will need to contact a member of the sub-committee. We have many to thank for the success of this site and the field days. Funding is from GRDC and the diamond sponsors are Commonwealth Bank, CSBP futurefarm and AGWEST. Thanks to DEM (Dowerin Events Management), AgriTech Crop Research for managing the site, and the local Meenaar Cropping Group.

Trial tests timing of N application with direct drilling and no-tillage.

Warm Season Crop Seminars

Held at the end of July and well advertised, the Seminars produced good attendances at all venues (Morawa, Kellerberrin, Katanning and Esperance). An excellent group of speakers produced challenging and logical discussions. Scott McCalman was a standout farmer speaker from Warren in NSW. Scott's farming system is a 'must-hear' story. He has developed a package that is robust, profitable and relevant to us all. We plan to have him back for our Annual Conference in February (23rd in Geraldton, 26th in Esperance, and 28th February–1st March in Perth).

Precision planter

WANTFA has recently purchased a precision planter. It is an 8-Row John Deere undergoing workshop additions to equip it for WA conditions—like fertiliser placement and improved stubble handling. It will be used to sow extensive trials this spring at Ashley Jones' farm north of Dowerin. Primarily, this planter will be restricted to the WANTFA trial programme. We are very keen to help, coordinate all trials and therefore trial designs. Angie Roe from Farm Focus Consultants, Steve Addenbrook of Pioneer Seeds and Bill Crabtree are the key people to talk to. AgriTech Crop Research (Peter Burgess) will be conducting the trial programme.

A big **thank you** to AGWEST, particularly Steve Trevenen and Monty House, for making available $33,000 to ensure the Warm Season Crop trials programme proceeded this year. There is a large amount of interest in growing Warm Season Crops from all over the state. The realisation that such crops will grow and the understanding and development of the suitable local production package is rapidly being learnt. With the expected energy input over the next few months, the knowledge level should increase dramatically. A 3–Row JD precision planter is being used by many, courtesy of JD in Esperance (through Ratten and Slatter). I know of at least three other units that will be operating (owned by farmers). Most farmers will continue to use their own seeders for sorghum and safflower.

Rotation site

We plan to develop a long-term diverse crop rotation site. It is likely to be adjoining Dowerin. A funding application has been submitted to GRDC and we are exploring other funding sources also. Other planning work is well under way. "Scary"? No!—Exciting" Yes! The model is based on Dwayne Beck's rotational site in South Dakota. Your committee has had this concept in mind for four years and enthusiasm for this is strong. We believe that agriculture in WA has a desperate need for a large Long-Term Rotation trial site that provides farmers with answers to complex interactive questions with no-tillage and stubble retention systems.

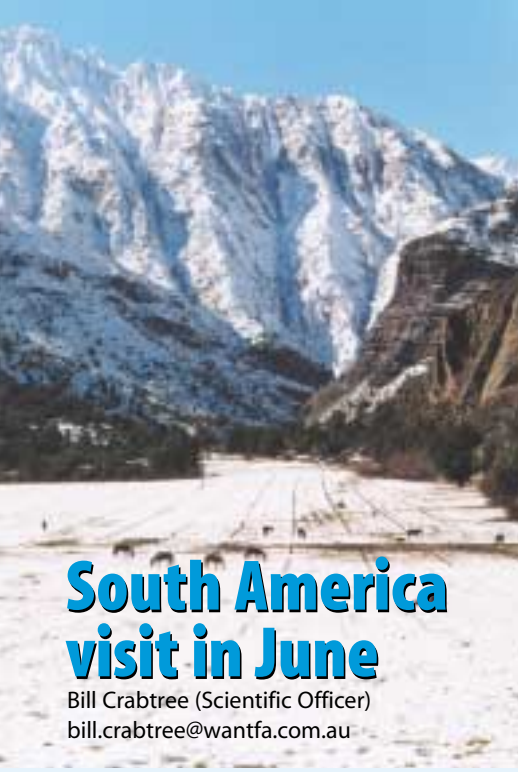
The next step is to seek farmers who are prepared to contribute financially to help buy nearly 200 ha of land. The farmer investment will help achieve:

1. Strong bargaining power to attract further funding.
2. Security of ownership for 10–20 years.
3. Useful information that can be applied on your farm.

Soon, you will be asked to contribute to this project. Funds will be required early next year. If anyone is prepared to contribute time or money to help make this project happen, I, or any other local committee member would love to hear from you.

Administration

John Duff is providing an administrative base in Perth for WANTFA. Mary Schick has left recently to take up another job closer to her home. Carl Parrella will take over Mary's role for WANTFA. (Carl has been working for John and is quite familiar with WANTFA and has met many of you.) Welcome, Carl. ■



South America visit in June

Bill Crabtree (Scientific Officer)
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I will briefly pass on my impressions of a recent visit to Brazil, Paraguay, Argentina and Chile. To summarise, my impressions of my visit are threefold; South American farmers:

1. **Had to adopt no-tillage due to severe water erosion risk and in fertile soil.**
2. **Have willingly embraced cover crops to add diversity to stop weeds.**
3. **Noticed how well the discs 'zero-tillage' stops weed problems.**

Brazil

About 400 km east of Sao Paulo (a city of 18 million), Monique and I visited the Ponta Grossa region (25° latitude) with Manoel Pereira and wife and son. Manuel is President of CAAPAS (the All-American No-Till Farmers Association) and is one of the pioneers of no-till in Brazil.

Manoel Perreria (left) with myself, his wife Cleide and son Manoel Jnr. in their impressive shed that show cases no-tillage development in Brazil.

Manoel is well respected among farmers throughout South America and began no tilling out of necessity in 1975. The farm he purchased in the early 1970's was not profitable, was eroding severely and grew poor crops. Unlike a couple of previous owners, Manoel adopted no-tillage and made the farm a success. A German farmer several hours north of Manoel adopted no-till only six months earlier—his name is Herbert Bartz.

Tractors in the no-till history museum at Perreria's.

Manoel farms with his son, Manoel JR, and they farm in two areas. The original farm is on tall prairie land with rainfall of 1,100 mm. The second farm is in an area of slightly more rainfall and was cleared of tall forest only in the last 10 years. They clear the land, apply 2 t/ha of lime and plant two soybean crops 12 months apart to build up soil nitrogen levels. During the winter they grow barley or wheat as cash crops, or oats as a cover crop to protect the soil from solar radiation, evaporation, erosion and weeds.

Their agricultural environment was new to me. Their soils are naturally acidic and are about 1,000 m above sea level. They can grow five crops in two years—usually three of these are cash crops. They have winter frosts, particularly in the low lying areas. Winter cereals are planted in May/June, corn is planted in August/September, and soybean is planted into a black oat cover crop. Yield potentials are high and Manoel Jnr has six workman who are busy throughout the year with these crops on the 550 ha sized farm.

Commonly used zero-till seeders —I could find no knifepoint seeders.

Seeding black oats as a cover crop into soybean stubble with no fertiliser.

Manoel Jnr has four John Deere harvesters. The only no-till seeder I saw was the double disc. The most popular seeder was the locally made Masear seeders (copied from Bettisin) and is usually 2.5–3.5 m wide. The tractors are mostly 80–120 hp. Labour is cheap at US$2–4/hr. Government laws allow 70% land clearing as the maximum. There is at least 150 million hectares of productive land that could still be cleared and cropped about 1,000 km north west of this region in the Mato Grossa State. No-till is fast becoming the norm in Brazil.

Weeds Conference—Brazil

Along with 700 people from 53 countries I participated in an international weeds conference. A pleasing aspect of the conference was a focus on non-chemical weed control methods. There was a lot of talk about biological control which might actually give some practical techniques. There was an exciting discussion on weed control in one session. Here I met three excellent Brazilian weed scientists who all responded several times each to my varying questions about no-tillage and weed control issues.

This open discussion continued for 40 minutes and was vibrant and the highlight of my week. The Brazilians involved were; Dr Claudio Purrismo who studies weeds with Manoel Pereira and is the head of the Brazilian Herbicide Resistance task force; Mr Eri Roman who was the first no-till researcher in Brazil (1972); and Donizeti Fornarolli who did a Masters on weed control with no-tillage. All these men are excited by what no-tillage does for weed control. Also involved in this discussion was respected weed authority Dr Clarence Swanton from Canada.

Claudio told me later that he was concerned by reports from Australia, issued about 10 years ago, that no-tillage was causing problems with resistance and he said this has not been a problem in their systems.

Paraguay

After the conference we went to Paraguay, travelling with Diego Yegros, a Zeneca (CropCare) Agronomist. We visited Inglo Kleiwer who farms 30 minutes travel west of Brazil.

The Paraguay agricultural environment is similar to Manoel's environment. We saw lots of cover crops plots (both warm and cool season cover crops) and a degrees of tillage trial. We could consider some of these cover crops for WA. The most popular cover crop for Paraguay and Brazil (in the region I visited) is the black oat, then nabu (a brassica), a mix of these two (produces 25% more dry matter), Indian hemp and crotaleria (a legume). The last two are warm season crops that grow very fast.

We met Erni Schlindwein (President Paraguay No-Till Farmers Association) who showed us some impressive no-tilled corn that might yield 10 t/ha. Erni is excited by yield improvements with no-till. Last year was a drought and his corn withstood the dry period well and yielded 5.7 t/ha while his conventional neighbours corn yielded only 3.5 t/ha. Erni has diversified into pigs, cows, fish, corn, soybean, wheat, oats and has only 160 ha though he rents about twice this area.

▲▲ *Inglo Klewer [left] and Diego show me their cover crop research in Paraguay.*

▲ *Called knife rollers, these no-cutting rollers crimple the cover crops to ensure they don't regrow when the crops have nearly finishing flowering.*

▲ *This is the traditional approach of growing corn. It is harvested, winter weeds can grow, then it is ploughed several times then sown to corn again. Cover crops put more desirable plants in the ground (and without fertiliser) to make them affordable.*

Chile and Carlos Crovetto
(18–19th June)

Carlos took us to his "Checquen" farm 30 km from Conception. He showed us his improved soil fertility and talked about how he stabilised his dramatically eroded soil. Carlos showed us some very deep gullies that did not exist before agriculture 300 years earlier. The erosion was dramatic, and Carlos says "it is terrible—terrible what our forefathers have done to this country". It is easy to see why he is passionate about no-till and stubble. He continues to fill in many enormous gullies—most were filled 20 years earlier.

Carlos has a building on his farm dedicated to the extension of no-tillage. People come from all over the world to see his work. Carlos has a good knowledge of soil biology and chemistry. His soils are loams and clays with a koalinitic base (dispersive—like our clays) and his environment is Mediterranean but he can irrigate corn, sorghum and soybean during summer. His main winter crops are wheat, lupins (Albus these days), barley and some canola. He also has a chicken farm and employs many workers (for a small fee). He uses the chicken manure on reclaimed soils to inject some fertility into them—this, he says, is very important!

Carlos talked a lot about improving soil biology and carbon levels. He works closely with University people and has read extensively. His library is large and he showed me many interesting books. Carlos believes that the Ca:Mg ratio in soil is important and is not keen on urea because of its acidifying effects. Carlos uses CAN and applies significant amounts of lime when the soil gets below a pH of 5.0 in $CaCl_2$.

Carlos is very energetic and has a passion for soil science. He believes that the soil should be looked after properly and then the crop will be happy and support good crop growth. He has no regard for contours or strip farming—techniques he had used—after he returned from several studying scholarships in the USA. Carlos has won many awards for his work.

Argentinian Pampas
(20–23rd June)

About 450 km west of Buenos Aires we met Roberto and Cynthia Peritti on their farm. A fertile and flat land—they call it the Pampas. No-till adoption is about 90% in his immediate area. Roberto showed me how he had aerially sown oats into soybean (before leaf drop), then harvested the soybean and the oats grew through the stubble. Perhaps we can do this on a summer rain at harvest on the south coast to increase summer water use.

They have little erosion concerns compared to the other three countries. Their soils are rich, flat and deep.

Carlos' stubble over the soil in Chile.

Wheat emerging in the flat and fertile Pampas of Argentina. Note the mostly closed slots near the wheat rows where the fertiliser was placed next to the wheat.

Roberto Perretti's seeder units that can be pulled behind each other to sow cool season grasses (wheat) or put alongside each other to sow warm season crops on wider row spacings.

Their best gains from no-till come from better timing and flexibility of management—with improved water use efficiency—especially in dryish years. They have 1,150 mm of annual rainfall and most of it falls in the summer. They can grow two crops in a year. No wonder Buenos Aires hosts many rich landowners (this was commonly said).

We met a friend of Dwayne Beck's called Cesar Belloso who is a private agronomist. He works with many good farmers and helps them to adopt no-tillage. He is a "big picture" person with a good knowledge of rotations, fertiliser and pesticides. We visited two farms; one a big farm of 4,000 ha at Santa Fe, called "Agro Uranga", where we saw them planting wheat into corn and soybean stubbles with a zero till seeder. Cesar explained that it is easy to no-till in their almost perfect soils and it provides lots of management benefits.

Study Tour
August 2001—South America

Monique Crabtree, Northam p/f (08) 9622 3395

Expressions of interest are asked for the coming Study Tour, set for August 2001. This will be an action-packed farm filled tour with a wives' concurrent tour. I will be on the tour and will accompany those ladies who have limited interest in agriculture in a range of activities.

We will visit Brazil, Paraguay, Argentina and maybe Chile for 12–14 days. Additional tours are options to visit South Africa for 4–5 days pre-South America or post-South America for a further 4–5 day tour to North America and Dwayne Beck.

The cost for going via South Africa will be about $5,500 (at current $A strength). This would include return airfares Perth/Johannesburg/Buenos Aires and all internal flights, hire of buses, airport transfers, hotel accommodation and travel insurance.

If you would like to come then please fax me. First in gets first option, and more firm details will be given in subsequent newsletters. We will require a deposit at a later date.

No-till seeder concepts

Prof Dwayne Beck;
www.dakotalakes.com

Dwayne Beck talks to the Esperance farmers about how he has developed his seeder concept.

At the Dakota Lakes Research Farm (South Dakota) we have been developing a seeder that gives versatility for various no-tillage cropping rotations and situations. This seeder tests the feasibility of combining the best features of row-crop planters and in high-capacity air seeders, to make a single machine capable of accurately seeding and fertilising all crops that we grow. This machine is not meant to demonstrate final design, as commercial companies will do that better.

Advantages of row-crop seeders

They provide extremely accurate depth control and count of seeds (singulation). There are lots of 'after market' options available for residue management and fertiliser placement options and these openers work well in wet conditions if properly adjusted or modified.

Disadvantages of row-crop seeders

Expensive on a per metre basis when rows are narrowed. They have a high maintenance cost with some designs. There is limited capacity for both seed and fertiliser and they require lots of time and expense to change between crops.

Advantages of air delivery seeders

Easily filled, emptied and transported with minimal moving parts. They have large capacity tanks which increase efficiency and, with some models, all fertilising can be done at seeding.

Disadvantages of traditional seeders

They lack accurate depth control, have limited capability in high residue situations, their seed metering is based on volume [not singulation] and they have limited capability in wet conditions.

Disadvantages of no-till drills

Intermediate in depth control accuracy between air seeders and row-crop planters (no parallel linkage). Metering is done on a volume basis and not singulation. They have a limited capacity and are very limited with fertiliser placement options. They have little or no ability to manage residue (move residue from the row area) and they are difficult to transport, fill, and empty.

Disadvantages of both present drill and planter designs

Down pressure capability is determined by frame weight and this makes them very heavy for wet conditions and too light in hard conditions. Also their down pressure is not uniform throughout the stroke and the frame height varies with ground conditions and load—down pressure varies with frame height. Also the frame wheels interfere with residue flow.

Concepts we are working with...

Weight distribution

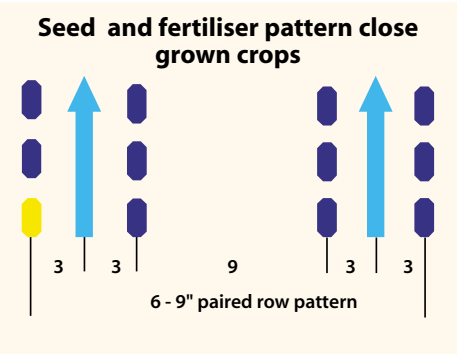
All weight is being carried by tall and fat tyres. The bridge hitch allows the weight of the cart and tractor to be used as down pressure. A bridge hitch allows the frame weight to be carried by tractor or cart tyres (tracks). Electrohydraulic controls are used to maintain the frame at a uniform distance from the surface. This is needed to allow weight transfer and it improves residue flow (no frame tyres) and ensures the toolbar height is uniform and independent of soil conditions and tyre squat.

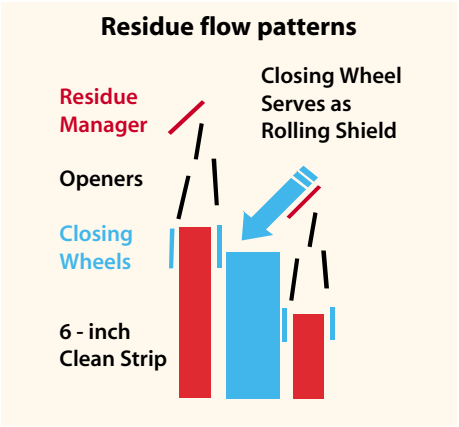
Parallel link and ground engaging components

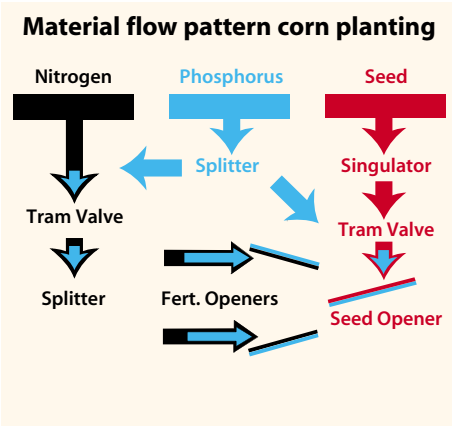
The parallel link provides 11" of vertical travel, an active hydraulic down-pressure, uniform pressure throughout the stroke and adds 11" to ground clearance. The ground engaging openers are on the multiple openers per parallel link. This retains accuracy for row crops, reduces costs for close-seeded crops and provides residue-managing capability in close grown crops.

Multiple opener

Three openers are spaced 3" apart on each parallel link. The parallel links are spaced at 30" centres on each of two bars (net 15" on centre). Uniform 15" or non-uniform 9–6–9–6 (paired row) patterns are used for seed. The crop residue is moved to a 9" gap and the single disc openers are at 5 degree angles. The openers trade roles, depending on the row pattern being used. All nitrogen and half of the starter fertiliser is placed within 3" of the seed, the other half of the starter is placed with the seed.







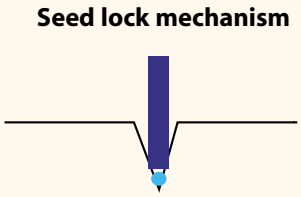
Why paired rows?

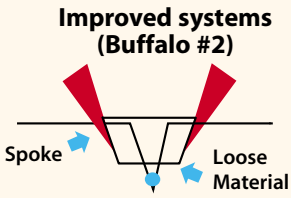
Narrow rows are preferred for good weed control and competition. The area that was disturbed has narrow rows. We also know that pathologists prefer wide rows and this system also has the wide row spaces. Residue management is improved and no fertiliser is placed in these gaps—which helps inhibit weeds. The fertiliser is also close to the seed row.

Materials handling

All materials, including seed, is stored in large bins and singulation of seed is performed at the toolbar. All rates are electronically and variably controlled and the material distribution pattern (15 inch to 6–9 row space) can be changed by tram valves, and, 'on-the-go' row-pattern changes are also possible.

We are pleased with the performance of our concept seeder and believe it provides greater management flexibility than is currently available in commercial seeders. Hopefully, such a system will be developed commercially sometime. For wet soils, they need to be given special engineering considerations, not discussed here. ■





Coming Events...

Meckering R&D Site: Pre-harvest field walk
9.00 am Thursday 26th October

WANTFA 9th Annual Conference 2001
23rd Feb : Esperance Civic Centre
26th Feb: Geraldton Queens Park Theatre
28th Feb–1st March: Perth

Trifluralin granules work in thick stubbles

Bill Crabtree, Scientific Officer, Northam,
bill.crabtree.wantfa.com.au

As part of the GRDC funded WANTFA Meckering trials, we have some exciting results using trifluralin granules and limesand mixed with trifluralin for ryegrass control in thick stubbles. The use of a solid carrier with full stubble retention gave up to twice the control of ryegrass and an extra 300 kg/ha of wheat grain yield.

This improvement comes from good penetration of the trifluralin through the stubble layer to where the weed seeds are located. In contrast, much of the liquid trifluralin becomes locked onto the stubble and does not reach the target weeds. Increasing the water volumes from 30 to 90 L/ha did not improve trifluralin efficacy. The solid carriers improved herbicide efficacy with the lower label rate (1.0 L/ha) giving good ryegrass control in the inter-row and the furrow. At higher trifluralin rates, with the solid carriers, the wheat plants were thinned—however this combination also gave increased ryegrass control in the furrow.

Canadian farmers have been using trifluralin and applying it to thick wheat residues with success for many years. Some report suggest that because Canadians apply trifluralin before the snow falls, the snow layer ensures even movement of the trifluralin on the soil's surface. My discussions with leading Canadian farmers in 1996 revealed that many farmers use granules in the spring, a week before seeding, and with good success. Also Winston Broun, a farmer from Coorow, demonstrated successful ryegrass control by mixing lime with trifluralin and applying it before seeding.

Method

Three trifluralin carrier types were used (lime at 2 t/ha, granules with lime at 2 t/ha, and water {at 30, 60 and 90 L/ha}) and 5 rates of trifluralin (0, 1, 2, 3 and 4 L/ha of 400 gai). There were two nil herbicide treatments, one with lime and one without lime.

A Meckering wheat crop that yielded 3.2 t/ha in 1998 was used for the trial. It had high levels of ryegrass (70% ground cover) and the stubble was standing undisturbed. The topsoil pH was estimated to be 4.8 ($CaCl_2$) and the site had 2 t/ha of lime applied in 1996. Trifluralin was applied on 21st June across the plots before sowing Westonia wheat with knifepoints and press wheels on 26 cm row spacings.

Results

There was a uniform ryegrass density of 325 pl/m^2 in the control treatments. The water carrier (conventional) achieved less than 50% in all treatments while both solid carriers gave effective ryegrass control of up to 80%. The 1 L/ha rate of trifluralin with granules gave better ryegrass control than the 2, 3 or 4 L/ha rate of trifluralin as a liquid. The solid carriers also gave ryegrass control in the furrows and in the inter-row. In contrast to some previously presented data, the water volume had no effect on trifluralin efficacy and this effect continued into grain yield.

Ryegrass control was not affected by lime without trifluralin. However, the lime did improve wheat grain yields and the trifluralin water carriers (averaged) response curve 'probably' should be shifted up 200 kg/ha to equate for this. Regardless, improved grain yields occurred by using solid trifluralin carriers, as opposed to liquid formulations. Limesand gave slightly better ryegrass control than the granular formulation with the higher rates (3–4 L/ha) but the lime-only carrier did not improve grain yields as much as the granules. In fact, the limesand increased crop damage at higher than 2 L/ha and this reduced grain yields.

The effect of the trifluralin mixed with solid carriers is an exciting finding and has broad ranging implications for no-tillage and stubble retention cropping systems and for other herbicides—particularly those that are more active in alkaline conditions (caution will need to be exercised on some of these).

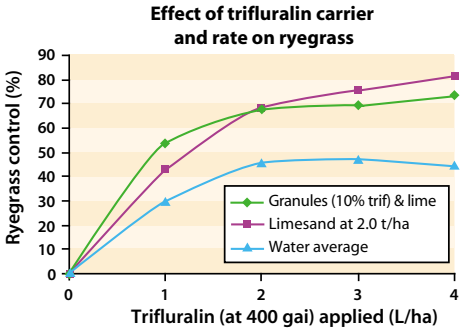
AgriTech Crop Research managed the trial work with sponsorship from Nufarm and kind assistance from Ray Fulwood (the owner of the land).

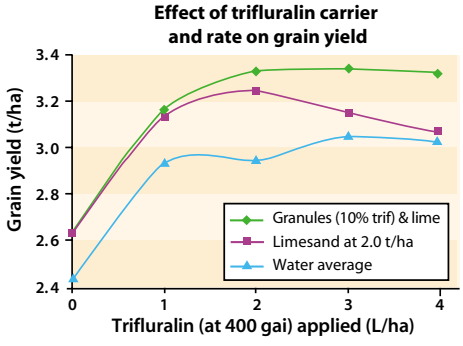
Similar work at East Maya

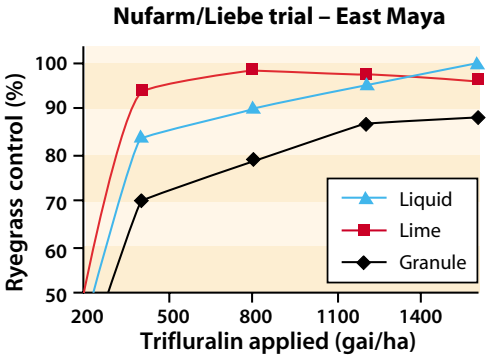
A similar trial which showed similar trends was conducted by David Sermon of Nufarm (at the time) and the Liebe Group. The stubble levels were half that of the Meckering trial.

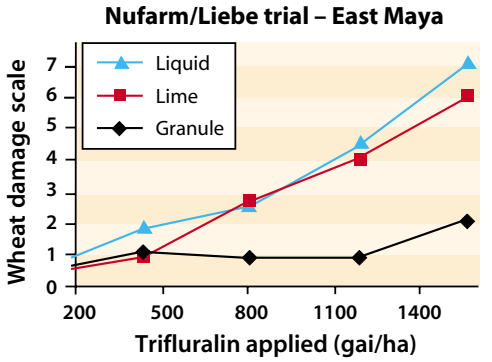
Their trial was sown on 23rd June on acidic loamy sand with a Flexicoil Bar with Agmore Seeding Boots and Press wheels. Arrino wheat was sown at 80 kg/ha. This was the third successive wheat crop after lupins in 1996.

No trifluralin (foreground) and 4 L/ha of trifluralin mixed with limesand—this was a bit hot on the crop (at rear) as more treflan was put into the nearby furrows. We are not sure why this happens and does not appear to with the granules.





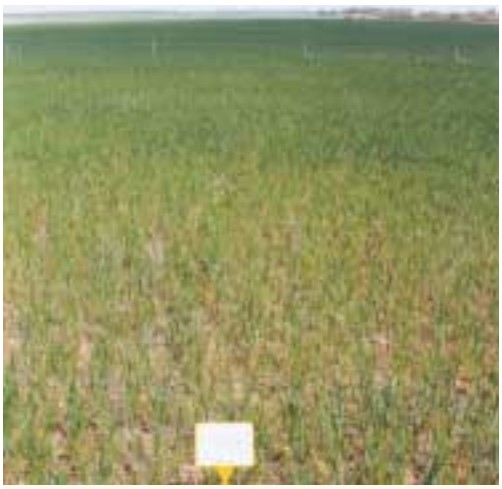




Amanda Falconer (left) and Stuart McAlpine are doing some great local work with the Liebe group near Buntine.

Results

Unfortunately, the 1.5 t/ha wheat crop was hailed and the grain yield data was lost. Water applied trifluralin was effective in this low stubble level trial. Granules and lime-sand carriers gave effective weed control, particularly at the old 2 L/ha rate (800 gai/ha). In this trial, both solid carriers give poorer efficacy than the liquid. The granular formulation caused much less crop damage than both other carriers.



Liebe Groups trial with wheat growing in wheat stubble where trifluralin was mixed with limesand or as a granule.

Don't delay trifluralin incorporation

Bill Crabtree, Scientific Officer, Northam

Results from this 1999 trial counter some comments made after a similar trial in 1998. Results from this more robust trial design suggest that, if possible, farmers should begin seeding immediately after applying trifluralin—regardless of the rate used.

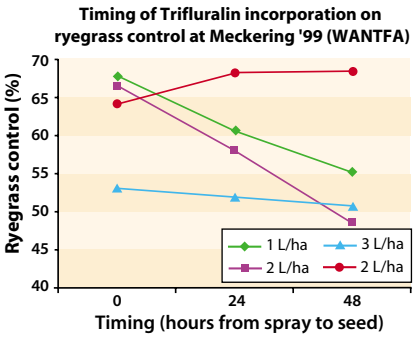
A wheat yield loss of 200–300 kg/ha (10%) occurred in this trial with high levels of ryegrass when trifluralin incorporation was delayed by 24–48 hours. This was despite ryegrass control being maintained with the high rates of herbicide.

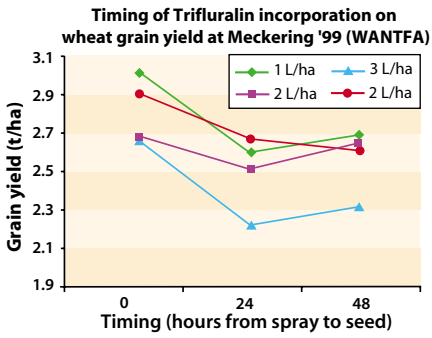
Interestingly, there was no difference in grain yield when trifluralin was incorporated with no-till was delayed by 24 to 48 hours, despite ryegrass control being less with the longest delay (see graph).

This work encourages farmers to consider placing herbicide sprayers on the front of their seeders or using the granular application method (which is cleaner). The previous paper shows how effective trifluralin granules can be at controlling ryegrass in thick stubble.

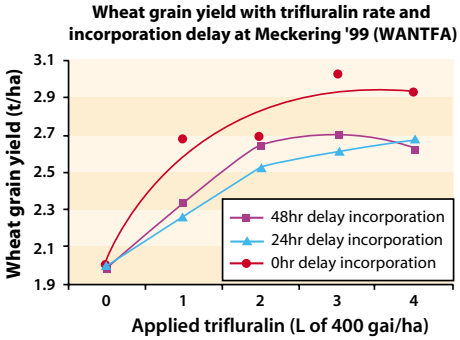
A Meckering lupin crop with high levels of ryegrass in 1998 was selected for the trial. The herbicide treatments were applied on the 31st May across the direction of sowing with knife-points and press wheels on 225 mm (9") row spacings. Arrino wheat was sown at 80 kg/ha. Urea was topdressed at 100 and 40 kg/ha at 6 and 9 weeks after sowing. The trial was sprayed for leaf disease.

The site had a uniform ryegrass density, with 777 pl/m^2 counted in the control treatment. Delaying the timing of trifluralin incorporation generally decreased its efficacy and decreased wheat grain yields from the first timing. Delaying seeding from 24 to 48 hours further decreased trifluralin efficacy for 1–3 L/ha rates, but had no impact on grain yield.





Ryegrass control was significantly less than in the previous years, with 68% being the highest in this work. However, the remaining weeds competed poorly with the crop. The grain yield with no herbicide applied was 2.0 t/ha.



Thanks to GRDC and Nufarm for each half-funding this work through the Meckering R&D WANTFA sub-committee. AgriTech Crop Research managed the site and the chair of this committee is Mr Geoff Fosbery. Colin and Ross Pearse kindly assisted with the trial and provided the land. Many thanks!

Soils are alive!

Dr Graham Osler, GRDC funded research scientist
Centre for Land Rehabilitation, UWA (08) 9380 3593

Our regular Soil Biology segment continues…

Animals in your soil

In the last *WANTFA Newsletter*, Daniel Murphy outlined the importance of organic matter for sustainability of farming systems and the role of microbes (bacteria and fungi) in organic matter turnover. In this issue, I discuss another important component of the soil ecosystem—the soil animals.

Soil animals are a vital component of the soil food web that decomposes organic matter (your cropping residues) and releases nutrients for crop uptake. Minimal research has been conducted on this component of the agricultural ecosystem in Australia and the potential for making the most use of these free resources is completely under-explored. Here, I outline what these animals are, how they impact on soil processes and discuss some of the impacts on them.

The animal community

The soil supports a huge array of animals. Most of these are concentrated in the top 10 cm of soil, although some are found at great depth. Practices which conserve topsoil will therefore also help to keep these important animals on your property. The table below gives an indication of the numbers of animals supported by a Western Australian agricultural soil can support.

		Canola	Wheat	Lupins
Protozoa	Ciliates	720 000	277 000	240 000
	Flagellates	15 500 000	9 800 000	8 500 000
	Ameobae	345 000	1 375 000	4 000 000
Nematodes	Bacteriovores	250 000	660 000	360 000
	Fungivores	500 000	825 000	320 000
	Predators	80 000	130 000	50 000
	Omnivores	65 000	125 000	35 000
Mites	Prostigmata	10 600	17 000	98 000
	Oribatida	135	625	1 700
	Mesostigmata	120	135	845
	Astigmata	0	0	2 400
Springtails	Collembola	950	50	4 500

An example of the densities of soil animals in Western Australian wheat fields. The values are the average number of individuals per square metre in the top 5 cm of soil under a canola–wheat–lupin rotation. The samples were collected near Moora in October when soil moisture was approximately 2%. It is not a complete list of the animals present in this soil and there are many species in each group.

Protozoans

Protozoans are the smallest soil animals. They are single celled animals which eat bacteria and fungi. The three categories of protozoans in the table are based on their morphology (their form and structure). Nematodes are another important group of soil animals that are well known to farmers because some species are produce diseases (pathogens). However, agricultural fields contain at least four other functional groups of nematodes which are not pests, but vital components in nutrient cycling processes. These nematodes are bacterial feeders, fungal feeders, predators and omnivores. Recent research in NSW has shown that there were at least 100 species of nematodes in a few agricultural fields. It is likely that there are similar numbers of species in Western Australian fields.

Arthropods

Arthropods (animals with legs) are an extremely diverse group of animals. This group includes the insects (bugs, beetles, ants, termites), centipedes and mites. Some of the most abundant soil arthropods are mites (which are related to spiders) and springtails (or Collembola). Again, some mites and springtails are pests (like red-legged earth mites and the lucerne flea, which is a springtail) but a vast number of species are only involved in nutrient cycling and decomposition. In a study conducted last year, we found a minimum of 24 mite species at three sites in the wheatbelt. If we had continued sampling we would have found even more. The mites and collembolans have a range of different feeding habits, with some eating only microbes and others predators prey on nematodes and other animals.

The role of animals in soil

Microbes drive the decomposition process, however, the grazing of soil animals on bacteria and fungi has a large impact on nutrient release (mineralisation). The animals can only use a certain amount of the nutrient they consume and the remainder is excreted. Some of this material is in a form that can be directly taken up by plants. If the animals eat organic matter, rather than microbes, then they can break the organic matter into smaller pieces. This which makes it easier for microbes to decompose the remainder.

Studies in the Netherlands have shown that amoebae, predatory nematodes and bactivorous nematodes are among the most important animals for nitrogen mineralisation in agricultural soils. Predatory animals can be important because they regulate the populations of microbivores, and therefore, the microbial populations can keep mineralising nutrients. This process is similar to controlling stock numbers on pasture. The arthropods have been shown to have a large impacts on the decomposition of organic matter. In studies where these animals have been excluded from decomposing material, the decomposition rates can be reduced by an average of 23%. The animals that eat microbes can help to reduce some diseases, however, there has been little research on this topic.

Impacts on soil animals

Management practices

Management practices have big impacts on small animals. David Wardle reviewed the effects of tillage on the soil ecosystem (*Advances in Ecological Research* 26 pp.105–185, 1995). He found that tillage has an especially large impacts on the larger soil animals, such as mites, springtails, spiders and beetles. Reducing tillage can increase the populations of these animals. However, there is not enough research to determine whether increasing the abundance of these animals will increase nutrient release from crop residues—although it is highly likely.

Crop plants

Crop plants can have impacts on soil animals. Canola has been reported to be a biofumigant of pathogenic soil organisms but our studies have not identified an effect of this crop on the non-pathogenic fauna. The table above shows that there can be large differences in animal abundance under different crops at certain times of year. For example, mite abundance under lupins was much greater than under the other two crops. This may reflect the different patterns of residue release from the crops: the lupins had shed large quantities of leaves when the samples were taken, whilst the soil was relatively bare under canola and wheat.

Change in vegetation

The change from native vegetation to agriculture has had a large impact on the number of animal species in the soil. We compared the number of species of one group of mites (oribatids) in agricultural fields and with the nearest patch of native vegetation at two sites in the wheatbelt. We found only 6 species in the agricultural fields (used for cropping) and 14 in the native vegetation patches. A study in South Australia showed that the number of fewer nematode species was also reduced in crops compared to native vegetation. We do not know whether some of these species would benefit soil processes in agriculture or whether they will survive in agricultural fields, even with reduced disturbance from practices such as no-till. However, ensuring that these reservoirs of diversity are maintained may act as an insurance policy for the future. These patches may also be useful for harbouring other animals which could benefit agriculture. For example, a recent study in the US showed that weed seed predation was much higher in complex landscapes (with lots of patches) compared to more simple landscapes.

Techniques of avoiding nitrogen toxicity

Bill Crabtree, bill.crabtree@wantfa.com.au

During 1999, WANTFA conducted three trials with several nitrogen fertilisers to determine simple placement and formulation options for avoiding fertiliser toxicity. The trials were conducted with wheat at Meckering, canola at Avondale and wheat at Gairdner. The Gairdner site did not respond to nitrogen application due to low rainfall and reasonable legume history—therefore little can be concluded from this site. The other two sites gave $250–$300/ha responses (1.9 or 0.9 t/ha for wheat or canola) to applied nitrogen and provided some clear messages. However, the magnitude of nitrogen responses depend very much on the season.

Both GRDC and United Farmers provided funds for the trials and AGWEST and AgriTech Crop Research conducted the trials.

Brief summary

The urea ammonium nitrate [UAN, marketed as Flexi-N by CSBP futurefarm] appears to have exciting potential for no-tillage cropping systems. At the one site where UAN was tested (Meckering) it gave significantly better wheat grain yield than all other drilled nitrogen fertilisers at the highest rate tested (110 kgN/ha)—except for topdressed urea IBS. This was despite a 20% loss in crop emergence with UAN, compared to no loss with the topdressed urea or a 33% loss with drilled urea. The plastic coated urea (PCU) caused the most damage at the Meckering trial—this is because the product coating was too thin. The controlled release urea (CRU) product possibly has the right thickness for no-tillage.

At all three sites, drilled Agrotain treated urea gave consistent grain yield and economic benefits at the low rate (28 kgN/ha) compared with drilled urea. Agrotain grain yield responses were most spectacular when used with canola (confirming WANTFA's 1998 trials) and opens the possibility for farmers to drill low rates of Agrotain treated urea with canola seed with "some" crop safety. It appears that canola needs significant N to be placed with the seed and these high responses were despite large (85%) losses in crop emergence with Agrotain treated urea at the highest rate of drilled N.

Plastic coated ureas could have a role in WA no-tillage agriculture if the cost of treating the urea could be kept to $A100/t and the manufacturers achieved the right thickness of coat. Calcium ammonium nitrate (CAN) performed poorly at all sites and in all situations with respect to grain yields and grain quality and economic returns. There was one exception where CAN performed well, although not significantly better than any other treatment—and perhaps not as well as urea applied similarly.

Method

Six different nitrogen fertiliser types were used at Gairdner and Avondale—urea (u), Agrotain treated urea (a), plastic coated urea (PCU), controlled release urea (CRU) and calcium ammonium nitrate (CAN)—and urea ammonium nitrate (UAN) was included at Meckering.

A control (0 kgN/ha) fertiliser rate was compared with three rates of most of the fertilisers (60, 120 & 240 kg urea/ha, being 28, 55 and 110 kgN/ha and for CAN, 16, 32 and 65 kgN/ha). CAN is marketed as being equivalent to urea in kg/ha fertiliser efficacy. All these rates and products were drilled with the seed, along with a conventional treatment (urea topdressed before sowing) with the same rates, with some exceptions. Exceptions were: PCU was drilled at 55 kgN/ha at Avondale, CRU was drilled at 55 kgN/ha at Gairdner, and CRU was only drilled at 55 kgN/ha at Meckering.

Nine other fertiliser combinations—drilled with the seed (d) or topdressed (td) 4 weeks after sowing (WAS)—were also included with a total of 120 kg/ha of urea or CAN (55 or 32 kgN/ha)—see table below. For the Meckering site, another UAN split application treatment was included (55 kg/N/ha). The UAN was sprayed evenly over the soil's surface before sowing, sprayed on the crop at 4 WAS and sprayed at flag leaf emergence at 21, 21 and 14 kgN/ha respectively.

Drilled[A]	With Drilled	Units of N	Topdressed 4 WAS	Units of N	Total units of N
Urea	–	27.6	Urea	27.6	55.2
Urea	–	9.2	Urea	46.0	55.2
CAN	–	16.2	CAN	16.2	32.4
Agro	–	27.6	Urea	27.6	55.2
PCU or CRU	–	27.6	Agro	27.6	55.2
PCU or CRU	Agro	27.6 + 27.6	–	–	55.2
PCU or CRU	Urea	27.6 + 27.6	–	–	55.2
PCU or CRU	Urea	46.0 + 9.2	–	–	55.2

A =PCU was used at Gairdner and Meckering, CRU was used at Avondale.

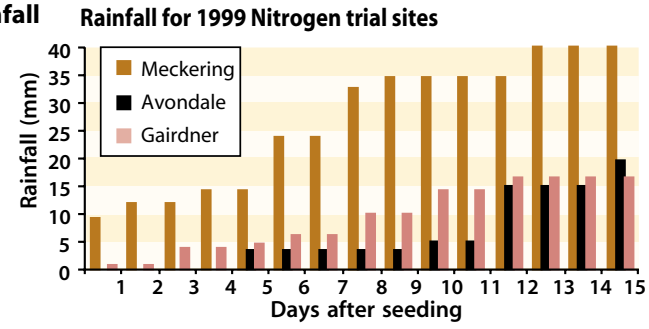
The plots were 1.6–2.2 m wide by 20–15 m long. The plots were sown with 180 mm row spacings with: a cone seeder with Great Plains double disc-opener (with a leading wavy coulter) at Gairdner; inverted "T" knife points (SuperSeeders) and harrows at Avondale; and knife points plus press wheels following at Meckering.

Site	Species & variety	Date sown	Seed rate (kg/ha)	Basal fertiliser (kg/ha)	Pesticides Used (L/ha)
Avondale	Canola, Karoo	31 May	7	80 (0:18:0:10:0)	Glyphosate (2) SpraySeed (2) simazine (2)
Meckering	Wheat , Westonia	11 June	75	70 (13:18:0:7:0)	Glyphosate (2) chlorpyriphos (1) Eclipse & Achieve (370/70 g/ha)
Gairdner	Wheat, Camm	14 June	80	80 (0:17:0:3:17)	Glyphosate (0.8) dicamba (0.2) trifluralin (2.0) Fastac (0.15) Impact (0.5) plus wetter 0.2%

Plant counts were taken 2–3 weeks after sowing. Dry matter cuts were collected and N uptake data generated by Bill Bowden (AGWEST Northam) at the Meckering site only, at the end of September. Harvesting was done with a small plot harvester in late December.

Results

Rainfall

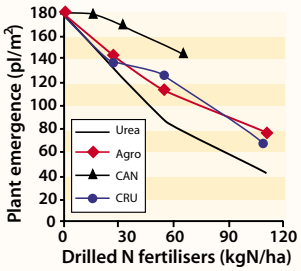


Both the Meckering and Gairdner wheat sites received regular rainfall during crop emergence. The canola site received only one small rainfall of 3.4 mm at 5 days after seeding, the next significant rain was 12 days after seeding.

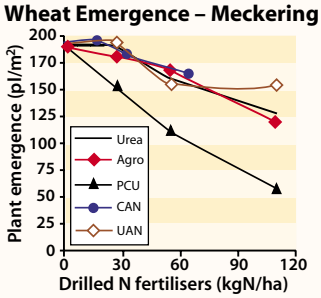
The growing season rainfall (May–October) was 395 mm for Meckering, 421 mm for Avondale and 290 mm for Gairdner. Gairdner had a dry winter, with only 32–34 mm falling between June, July and August.

Site	Analysis	Emergence (pl/m²)	Protein or oil (%)	Grain yield (t/ha)
Gairdner	LSD at 5%	37	0.27	0.77
	CV	17	1.5	15
Avondale	LSD at 5%	21	1.7	0.38
	CV	18	1.8	22
Meckering	LSD at 5%		0.99	0.64
	CV		6.6	13.4

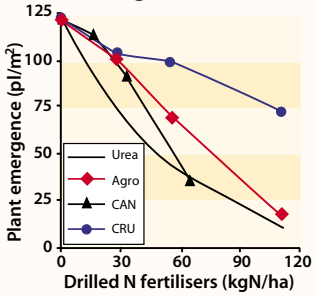
Wheat Emergence – Gairdner



Wheat Emergence – Meckering



Canola Emergence – Avondale



Emergence

Increasing drilled N fertiliser rate with wheat and canola decreased the crop emergence by 30–90%. Urea caused the most seedling damage at Gairdner and Avondale, however PCU gave the greatest toxicity at Meckering.

The CRU fertiliser at Avondale gave significantly better canola emergence than all other products at the high rates of drilled nitrogen. Emergence increased sixfold over the drilled urea at the 110 kgN/ha rate with CRU.

Grain yield

The Meckering wheat and Avondale canola gave increasing grain yield responses to increased N fertiliser rates. At the Meckering site, only topdressed urea (IBS) and drilled UAN gave very high grain yields at the 110 kgN/ha rate. For canola, most products gave response curves just below the topdressed urea IBS treatment, except for Agrotain treated urea and CRU. Both of these products produced sharper response curves which were maintained at the highest rate of 110 kgN/ha. There was no 'real' grain yield response to nitrogen at Gairdner.

Grain quality

Increasing the applied nitrogen generally increased wheat grain protein and canola grain oil content. At the highest rate of applied nitrogen, there were consistent trends with wheat—the PCU, Agrotain and drilled urea gave higher proteins than the topdressed urea. With canola, the urea and Agrotain treated urea decreased the percentage of oil at the high N rates.

Economics (using January 2000 prices)

Assume		$/t	%N	c/unit N	Pool wheat price (1999 harvest) with protein and oil premiums
1. Urea	=	$225	0.46	0.49	ASW @ $175/t for <10% protein (50 c less for every 0.1% less)
3. Agrotain	=	$292	0.46	0.63	APW @ $180/t for >10% protein (50 c more for every 0.1% more)]
2. CAN	=	$295	0.27	1.09	AH1 @ $192 for >11.5% protein (50 c more for every 0.1% more)
4. PCU	=	$350	0.46	0.76	Freight, storage = $22/t for wheat and $32/t for canola
5. CRU	=	$330	0.46	0.72	Growing costs [no N] = $150/ha for wheat & $182 for canola
6. UAN	=	$219	0.32	0.68	Topdress N = $5/ha, Drilled & foliar are no cost

Code[A] + Units of N/ha	GY	Protein	Meckering ($/ha)	Code[A] + Units of N/ha	GY	Protein	Gairdner ($/ha)	Code[A] + Units of N/ha	GY	Oil (%)	Avondale ($/ha)
uan110d	3.8	10.3	$385	a28d	3.5	10.9	$570	pcu55d	1.42	44.8	$234
u110td-ibs	3.6	9.6	$349	u28td-ibs	3.4	10.6	$548	u9d+u46td	1.31	45.0	$212
pcu27d+u28d	3.4	8.8	$344	u27d+u28td	3.3	11.0	$530	a28d	1.25	44.1	$199
cru55d	3.4	8.9	$321	u110td-ibs	3.4	11.3	$524	cru27d+a28td	1.31	43.9	$198
u9d+u46td	3.2	8.3	$314	can27d+can28td	3.5	10.9	$524	a55d	1.28	44.2	$193
a27d+u28td	3.2	8.9	$306	cru55d	3.3	11.2	$523	cru110d	1.41	44.5	$193
pcu55d	3.3	9.0	$302	pcu27+a28td	3.3	11.4	$523	cru55d	1.27	44.7	$188
u55td-ibs	3.1	8.2	$302	pcu27d+a28d	3.3	11.2	$516	a110d	1.37	42.8	$178
uan21,21,14	3.1	8.9	$297	u55td-ibs	3.3	11.1	$513	a27d+u28td	1.18	44.4	$160
u110d	3.1	11.4	$295	u28d	3.0	11.0	$480	u110td-ibs	1.22	45.0	$153
pcu27d+a28d	3.1	9.0	$290	0	3.0	10.2	$471	cru27d+a28d	1.16	44.3	$153
pcu27+a28td	3.1	8.9	$280	a27d+u28td	3.1	11.2	$470	u27d+u28td	1.12	44.6	$147
u27d+u28td	3.0	8.6	$278	a55d	3.1	11.0	$466	cru46d+u9d	1.12	44.8	$142
uan55d	3.0	9.5	$275	pcu27d+u28d	3.0	11.1	$464	cru28d	1.06	44.5	$139
a55d	3.0	9.5	$271	pcu110d	3.2	11.8	$463	u55td-ibs	1.07	44.6	$130
u55d	2.9	9.5	$271	pcu46d+u9d	3.0	11.2	$455	u55d	1.02	43.8	$114
a110d	3.0	11.4	$261	pcu55d	3.0	11.1	$455	cru27d+u28d	0.96	45.0	$95
can32d	2.8	8.8	$257	a110d	3.1	11.5	$451	can27d+can28td	1.04	44.8	$89
u28d	2.8	8.3	$256	pcu28d	2.9	10.9	$441	u28td-ibs	0.86	44.6	$78
can27d+can28td	3.0	8.6	$253	u55d	2.9	11.2	$438	u110d	0.99	43.4	$77
u28d	2.6	9.1	$244	can65d	3.0	11.4	$415	can32d	0.89	44.5	$69
pcu46d+u9d	2.7	9.2	$229	u9d+u46td	2.8	11.0	$411	can65d	0.98	44.7	$62
u28td-ibs	2.4	8.7	$211	can32d	2.8	11.0	$409	u28d	0.70	43.9	$27
can65d	2.8	9.9	$203	u110d	2.8	12.0	$408	can16d	0.65	44.2	$10
a28d	2.5	9.1	$203	can16d	2.6	10.7	$387	0	0.40	42.7	-$ 55
pcu28d	2.5	8.4	$200								
can16d	2.3	8.8	$186								
pcu110d	2.6	10.4	$163								
0	1.9	8.7	$135								

[A]code, where: d = drilled with seed,
td = topdressed 4 WAS,
ibs = immediately before seeding,
a = agrotain and
u = urea.

Improving sandplain productivity using renovation cropping

Fran Hoyle and Keith Devenish, AGWEST Northam (08) 9690 2148

Many farmers in the northern regions of WA see the need to have a crop in their rotation that will fix nitrogen, compete well with weeds and that can be sacrificed at flowering to ensure that no weeds set seed.

GRDC has funded a 4 year project to investigate this renovation cropping technique, utilising tools such as green and brown manuring. A number of trials have been conducted (see AGWEST's website), including this one—on a deep sandplain soil at Yuna.

Three renovation treatments were imposed at flowering in September 1998 on a second-year regenerated Cadiz seradella stand. Renovation consisted of green manuring (discing), green mulching (slashing) and brown manuring (chemical desiccation). A matured pasture stand was used as a control treatment (ungrazed).

The Cadiz produced 4.1 t/ha of dry matter, estimated to provide a total of 110 kgN/ha with about 40% or 44 kgN/ha likely to be available at seeding in 1999. Amery wheat was sown on 3 June at 75 kg/ha with 110 kg/ha Super Copper Zinc Molybdenum at seeding. Urea was topdressed two weeks after seeding @ 0, 30, 60 and 90 kgN/ha.

Results

The percentage of undecomposed material remaining on the soil surface at seeding in 1999 varied from 5–10% for the renovation treatments. Approximately 10% remained for control and mown treatments, 8.5% for the brown manure and 5% for disced. Nitrate N available at seeding in 1999, was higher for green manure and green mulch treatments in the 0–10 cm topsoil. Green manure treatments also indicated higher levels in the 10–30 cm horizon.

Green manuring and mulching gave higher yields than brown manuring or the control. However, when nitrogen was applied the brown manured treatment performed as well as the other two renovation treatments (see graph following). Grain yield increased by up to 36%. Nitrogen increased grain yield, protein and grain weight (by volume).

A response to nitrogen was observed in treatments up to 90 kgN/ha for grain yield (Figure 1) and protein. Black point (%) gave a significant interaction between incorporation and N. Grain screenings were less than 5% with no treatment effects, but reductions were observed with applied nitrogen.

Renovation cropping also demonstrated potential to be part of integrated weed management for herbicide resistance (see table below). A low ryegrass background population was observed at this site, future research sites will be chosen for high background populations and possibly resistance status to determine success under more testing conditions.

Treatment	Ryegrass (pl/m²) 1998	1999
Control	6.0	50.7
Green mulch	10.3	0.7
Green manure	9.7	3.3
Brown manure	6.7	1.3

Figure1. Wheat yield response to renovation cropping techniques and N application (kg/ha)

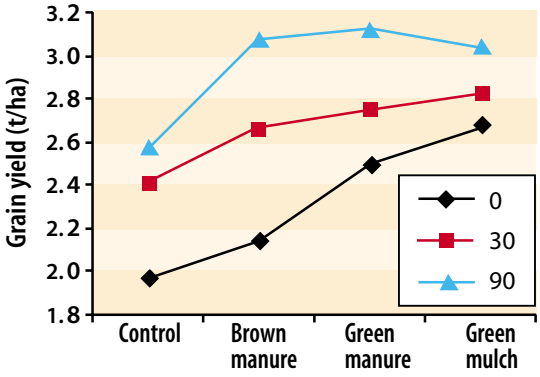
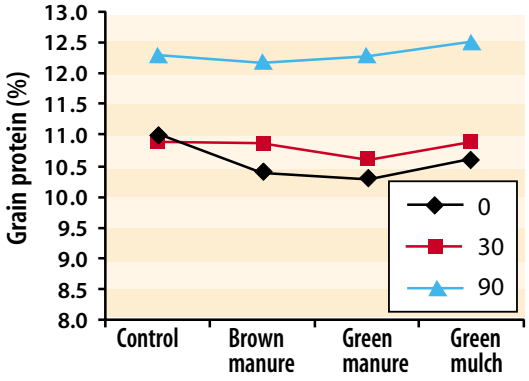


Figure2. Wheat protein (%) to renovation cropping techniques and N application (kg/ha)



The green manure incorporation of Cadiz in 1998 was difficult to do due to its 'vine-like' nature. However, there was a high level of breakdown over summer, with 267 mm of rain falling during Jan–May and there were no observed problems seeding into the residue in 1999.

...renovation cropping can benefit soil physical characteristics while improving production...

Renovation cropping techniques at this site were most beneficial where nil and 90 kg/ha nitrogen treatments were imposed. Average yield response across treatments compared to the control were 23% at 0N, 14% at 30N and 19% at 90N.

Renovation cropping can benefit soil physical characteristics while improving production. The control treatment was not grazed and therefore is likely to have contributed more nitrogen than otherwise likely.

Very wet conditions immediately after seeding may have contributed to losses in available nitrogen through leaching. In drier years the breakdown of organic matter and the response to nitrogen will differ—particularly for the different incorporation methods.

Brown manuring appears to have potential, particularly on fragile or erosion prone soils and may provide a viable alternative for these soil types and in reduced tillage farming systems. ■

Double disc for less weeds!

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My farming experience is different to most, as I have been farming a relatively short time and did not have experience to fall back on. My wife and I attended Muresk Institute of Agriculture in the mid-80's. She was a better student than me and achieved a degree in Agriculture. After working for the Department of Agriculture at the Ord River for 2.5 years we then worked for Argyle Mining, until buying our farm at Munglinup in 1992 and then farming it full time in 1994.

1994 was one of the driest years on record for the Esperance district and the beginning of three dry years in a row (and it doesn't seem to have stopped raining since then!). So it became clear that farming was going to be a big challenge. In 1996 we also leased another farm.

Why no-tillage?

The sheep industry was doing its best to self-destruct so cropping was the way to go. No-tillage along with the method of winter cleaning of grasses and saving summer moisture with early spraying made a lot of sense. The combination of light fragile soils, strong winds and, in those years, minimal summer moisture meant that conservative practices were going to be essential.

No-tillage farming offered this and it also offered for people starting off like ourselves the ability to put together a farming plant that was capable of a reasonable area for minimal capital outlay. The importance of this last point should not be underestimated as any business getting started has a very tight cash flow and is therefore vulnerable to failure. A no-tillage farming system has given us the ability to crop successfully in a large range of conditions—from dry years to wet years—and has taken a lot of the production risk out of farming.

Knife points caused too many weeds

We started with knifepoint seeding which was okay until we went into closer rotations and stubble blockage problems. We were also observing that the soil throw from the knifepoints was encouraging germinations of ryegrass in the crop.

I believe double disc openers, without a leading coulter, can achieve the benefits of true no-tillage because there is no soil throw and inversion. I think that this is important because of reduced weed germination post-seeding, no ridges of soil to dry out and reduce the risk of wind erosion, and keeping soil structure intact.

Ben made a cheap conversion of his John Shearer combine to a zero-till Great Plains seeder.

▲ *Stephanie inspects wheat for leaf disease.*

▶ *Ben enjoys the confidence he has in lupins emerging through wheat stubble on the wind erosion prone south coast.*

The decision was made to convert the combine with Great Plains double openers because they had the track record and were the cheapest on the market (the cash flow issue again). An important point with using this type of opener is the low horsepower per row required—therefore reducing tractor capital costs and running costs. Our seeder now has 20 rows at 25 cm spacing. The reason for wide rows was to reduce the capital cost of buying the row units.

The biggest changes to the paddocks have been an improvement on the compacted clays where they are now softer and aerated. Earthworm activity is also noticeable. Since using the disc seeder we have observed a build up of organic matter in layers of breakdown similar to what you see in the bush land. We also have confidence to plant into marginal moisture conditions and still achieve good emergence. It is also very nice to pull into a paddock of thick stubble at seeding time and know that there will be no blockages.

It became apparent that there is a need for an efficient and safe spraying system. Like many others we started with a Computer Spray (I never did find the computer!). This did the job but was really limiting with things such as agitation, accuracy and operator safety. The window for optimum spraying conditions can be quite small so when the conditions are right we needed to do it quickly. Getting a new boomspray was probably the single biggest productivity gain we experienced.

Perhaps lucerne...

As to rotations, we are in a rotation of wheat with lupins on the lighter soil types and manipulated clover/medic pasture on the clays and, more recently, canola as well. Because of the pasture phases, sheep are part of the system but in declining numbers.

In future we would like to go into a more serious phase cropping system. Possibly having up to 25% of the farm under lucerne at any one time. Lucerne has re-emerged as a popular pasture that will fit a cropping rotation as it has proven ability to lower water tables, gives an opportunity to combat herbicide resistance and builds fertility.

If 25% of the farm was in lucerne, at any one time, and each lucerne phase was 4 years, then the crop phase would run for 12 years. Therefore the crop phase would have to be well organised and may include warm season crops and green manure pastures.

Some random thoughts

- A challenge with lucerne—if farmers don't want livestock on their farms—is how to make money out of it. Maybe down the track an export hay business out of the Esperance Port would be viable?
- Like many others, we are removing fences to create larger paddocks which helps efficiency and makes rotation crop types in blocks easier.
- Changing boomspray widths would be good as this will change the point of overlap and underlap which helps prevent the same sections of the paddock being under or oversprayed.
- Yield mapping would be good to try, making it possible to assess with harvest data test strips of different treatments without wasting harvest time. If information gathered from yield mapping allowed variable rate seeding, then this may generate some savings through better targeting nutrients.
- Wind erosion should be a thing of the past as we have the technology in our farming system by using disc seeders and retaining all stubble (although stubble burning seems to be coming back in fashion recently).
- Rising water tables are a reality to anyone that has been looking underground, and every trick in the book is going to be needed to reverse this trend, including perennial pastures, warm season crops, longer season winter crops and ground water level monitoring.
- Lifestyle needs to be included in any planning of a farm system, things like allowing sufficient time for holidays and time with children. ■

Stephanie and daughter Sally inspect peas emerging through wheat stubble three weeks after sowing.

Summer crop research at Quairading

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Background

The South Mortlock Catchment Group was formed in 1990 to find ways to decrease water loss and improve the quality of water flowing out of the catchment. To this end, we have planted 600,000 trees in the valleys and creeks. Eight years ago we installed 120 piezometer holes to monitor the water table. The results are recorded twice a year by local farmer Lin Harris, and the data suggest that the water table has stabilised, and in some cases (like John O'Hare's farm) it dropped.

What does this have to do with No-till? Put simply, our tree-planting program is running out of low areas to do its job on, and we now need use more water on our more productive soils. Few farmers want to plant trees on productive soils, so we are exploring other potentially profitable alternatives up slope. So we did two warm season crop research trials in the spring of 1999 to see if they would be a viable option. We also wanted to see if there is any advantage in using a precision seeder.

Method

Site manager Greg Ferguson (ex–Monsanto, now a farmer) selected and pegged out a 13 ha on Robert Peacock's farm. The site is reasonably high on the landscape, at the head of a valley, on a sandy loam with some stubble cover. The site was sprayed one month prior to seeding with 1.5 L/ha of Sprayseed and 150 mL/ha of Chlorpyrifos. The soil's pH was 5.1 ($CaCl_2$), with a K of 30 ppm and P of 17 ppm. Nine different crops were sown in two trials into a full soil moisture profile. The summer rainfall was much higher than normal.

Nine species and varieties were tested. They were Hysun 25 sunflower, Jumbo forage sorghum, Cow Pow forage sorghum, DK grain sorghum, Shiroe millet, Sona chickpea, safflower, maize and Delta Opal cotton (maize and cotton were sown in unreplicated strips). The variety trial was sown with a modified 753 Chamberlain combine set up to sow every third row at 27" row spacings. Agstar + TE was drilled at 70kg/ha on 9" row spacings—to avoid fertiliser toxicity.

Plants were sown on 4th October with a soil temperature of 14°C in plots that were 10 x 150 m with 3 replicates. Achieving the target sowing rate was difficult as we needed to calculate plants/m2 rather than kg/ha. The seeding rate varied from 2.5–60 kg/ha depending on seed size and species. Urea was applied to the whole site at a rate of 70 kg/ha on the 13th December after 7mm of rain. Endosulfan was also applied in mid December, at a rate of 1 L/ha, as a precautionary measure after we noticed some insect damage.

▲ *Cotton (centre) and corn (right) did not perform compared to the surrounding sorghums.*

▲ *Angie Roe (left) and the Davies brothers inspect millet that yielded 1.2 t/ha.*

▼ *Robert Peacock (left) and Wayne Davies observe how tall the forage sorghum grew. Behind this is part of the large trial area.*

Results

Two days after sowing, the site received 23 mm of rain which allowed for an almost perfect germination of all crop types and summer weeds (mostly wireweed). These unchecked weeds would have reduced yields. At 6 weeks after sowing all crops were doing well and the summer rainfall totalled 244 mm.

The millet also performed well. The average yield off the harvester was 1.5t/ha. Shiroe Millet looks to be a viable option, especially at the current price. A more average annual rainfall pattern may result in a lower yield, but never the less, the results were encouraging.

Grain sorghum performed well, with one test strip yielding 2.6 t/ha (when on 0.5 m row spacing), although the average yield was only 0.5 t/ha. Wireweed competed vigorously with the sorghum and it was sprayed with 1.5 L/ha of Roundup only 14 days before harvesting (a bit too early).

Both Forage sorghums grew well with some patches reaching 2 m in height. Clayton Butterley from AGWEST Northam did plant cuts. Plant dry matter averaged 8.7 t/ha and therefore these sorghums probably are suited to our farming systems.

The sunflowers, chickpea and safflower became stunted, suggesting a problem with nutrition (P and K), soil type and pH. Some sunflower plants grew well on the better soil but when their heads emerged, the parrots chewed them off at the stem. Safflowers and chickpeas looked good at the seedling stage but did not grow beyond that.

Maize and cotton were grown in demonstration strips, and did grow, although only marginally better than chickpea and safflower. They grew well enough to warrant further work.

Precision seeder trial

Another trial was sown with Colin Steddy's secondhand precision seeder (Tecnahec) with skid plates which could not handle stubble and had limited plates. It was used on 1 m row spacings and was sown on the 6th October. We only successfully trialled forage sorghum and a test strip of grain sorghum which was sown with the precision seeder.

Conclusion

Our original plan was to demonstrate the viability of summer crops given a normal rainfall pattern—which did not happen. Summer crops are currently viewed as 'opportunistic' and only to be sown on low lying areas which get too wet in winter months. With more research these crops may become a profitable part of our rotations—on more than just the wet areas.

Sponsors

Thanks to the following companies who funded the research; CSBP futurefarm, Wesfarmers, 4 Farmers, WANTFA, AGWEST and Farm Focus.

Sowing on time and holding moisture

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I farm with my parents, Chris and Margaret, and my younger brother Simeon. We have three properties in the Cascade region north west of Esperance. Today we are farming 10,800 ha, which ranges in rainfall from 350–400mm, and soil type from gilguy (crab-hole) and other heavy soils—high in pH to blue mallee acidic sands. Our cropping program has steadily increased to about 6,400 ha this year with the remaining land either as medic or sub-pasture.

We have been using reduced tillage methods since 1990. From 1990–92 full cut direct drilled legumes into stubble and some cereals into pasture—out of necessity—due to the late breaks to the season. Breakout was a limiting factor, so in 1993 we upgraded to what we thought would be enough breakout.

In 1994 we began using SuperSeeder points and no-tilled about one third of the program with good results in a very low rainfall year statewide. In 1995 we continued with SuperSeeders and added press wheels. In 1996 we needed more breakout to achieve better depth control so we moved to an 820 flexicoil on 9" spacings with press wheels and harrows.

Today we run two 820's on 9" spacings with press wheels and SuperSeeder points combined with Primary Sales flexi-boots. This setup is used to sow our entire program, of which about 75% is no-tilled with the remainder having one cultivation prior to sowing. Generally we have been cultivating where gypsum is to be applied, although in the last two seasons some cultivation has been used to control summer weeds after the floods where chemicals would not do the job. With no-till, I think we are definitely maximising our investment in seeding equipment.

Rotations

Our rotations are:

- pasture\wheat\malt barley\pasture
- peas\wheat\barley\vetch\wheat\barley
- canola\barley\peas\wheat.

Some 60% of the farm is in a continuous rotation, and until we find another legume suitable for heavier high pH soils pasture, it will still remain that way. Harvesting large areas of the two current legumes is one problem we are overcoming this with good results from swathing vetch last year.

Nutrition

Since the adoption of no-till we have had some problems which are mainly related to nutrition. Reduced mineralisation with no-till resulted in higher rates of nitrogen required. Due to high pH soils we have had increasing symptoms of zinc and manganese deficiency so much that today we are foliar treating 80% of our cereals for this problem. Maintenance levels of trace elements are still being applied with our compound fertilisers. But we do not believe that spending money on luxury levels of soil applied trace element fertilisers is the way to go because trace elements are locked up in our soils and may never be available to the plant. We are now selecting varieties which are less susceptible to manganese deficiency.

No-till benefits

Through the adoption of no-till, our wheat yields have been increasing due to improved time of sowing and increased use of rainfall. Barley yields, on the other hand, have probably decreased a little since we have pushed it into the second cereal after pasture and we have to be careful about to much nitrogen as we are aiming for malting quality.

After two bad years of summer floods the no-till approach has saved us many erosion problems. The control of summer weeds has enabled us to establish a crop using moisture stored from the floods which would have otherwise been quite dry years.

One question for other no-till farmers would be: "How do you control windmill grass without cultivation on heavier soils?" This has caused us some problems during this summer.

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