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Western Australian No-Tillage Farmers Association (Inc)

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Trifluralin and lime in stubbles

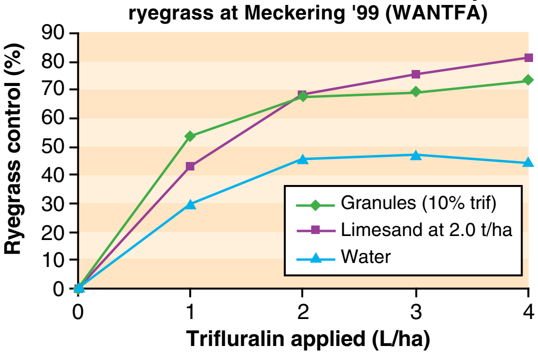
Some exciting trial work this year has confirmed farmer Winston Broun's experience at Coorow with limesand mixed (up an auger) with trifluralin.

WANTFA's trial at Meckering, through AgriTech Crop Research, shows that 2 t/ha of lime mixed (in a cement mixer) with trifluralin (or as granules) greatly improved the efficacy of trifluralin in thick wheat stubble. There were 380 ryegrass/m² in the control (see table and photo below). The Liebe Group have a similar trial at Buntine this year.

You may recall my suggestion from Canada in May 1996 in the WANTFA Newsletter (page 4), that we should re-visit granules in stubble with no-till. Farmers John and Paul Smith from Welbungin (phone 08 9685 1261) were also inspired by a visit to Canada in 1994. They mixed various trifluralin rates on the shed floor with buckets and shovels, with 35 kg/ha of river sand. They had good ryegrass control in thick stubbles with 2 L/ha of trifluralin—where the sand was spread evenly.

Trifluralin mixed with limesand in the foreground controls ryegrass compared to no herbicide at rear.

Effect of trifluralin carrier on its activity on ryegrass at Meckering '99 (WANTFA)



Higher rates did not improve control much and gave some crop damage.

Victorian farmer Rob Ruwoldt, from Murtoa, successfully used trifluralin granules in thick stubbles for several years in the early 1990s. Rob's experience fits WANTFA's 1999 trial work, in that 1 L/ha of trifluralin, as a granule (or with limesand), gave similar ryegrass control as twice the herbicide rate when used as a liquid. Rob also found that ryegrass control was better in the furrows with granules. Next year we will do more trials. ■

WANTFA Coming Events – 2000

28th February	Pre-conference seminar	Geraldton
1st March	Pre-conference seminar	Katanning
3rd March.	Pre-conference seminar	Esperance
7–8th March	Annual Conference	Muresk

See page 282 for more details.

Canola hates barley and wheat straw

How sad this is! University studies in NSW, by Sarah Bruce,

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

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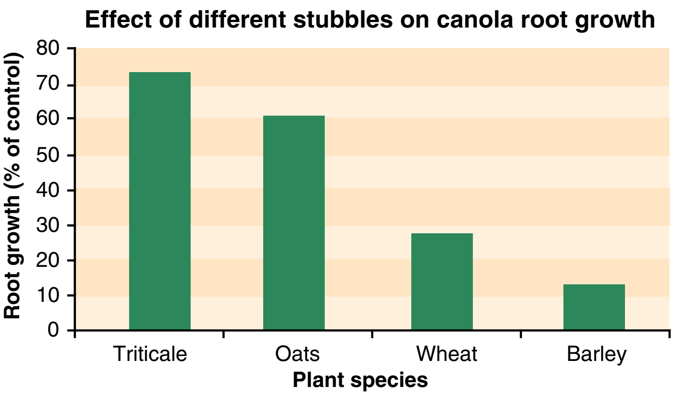
Canola at Kellerberrin in July struggles through thick wheat straw.

have confirmed farmers' suspicions that canola, when planted into thick wheat or barley stubble, performs poorly. Barley is worse than wheat! (See the table below.) Canola growth is severely suppressed by acids, or leachates, that leak out of straw. The same study showed that canola germination was suppressed by 50% with Janz wheat.

The Waters brothers (contractors) from Wellstead have observed that the problem is worse when discs are used compared with 'knives'. Obviously, removing stubble with tillage or burning reduces the problem, and maybe creates another one! However, this confirms the idea that cereal straw suppresses plants (in this case, weeds) and should be used to our advantage. Again, residue managers would have a role here!

We know that often canola thrives on lime. Perhaps the lime is neutralising the acidic leachates in some cases. And then we have the "trifluralin-mixed-with-lime" idea. *(See previous story)*

Professor Jim Pratley is a supervisor of this stubble work and he will be one of our speakers at the WANTFA Annual Conference at Muresk on 7–8th March 2000. ■



Canola tolerates salty soil

Several farmers have noticed how well canola has performed in salty areas. This has surprised many and should give you some confidence to grow it closer to bare salt areas. ■

Spray oils may increase disease risk!

Several farmers have said that crop diseases have occurred soon after spraying. Speculation suggests that it is the oil, added to the spray, that has desensitised the plant to the disease. This suggestion makes sense because oils do strip protective waxes off plants, which allows for easier entry of both herbicides and pathogens. Using wetters only may be an adequate compromise. ■

Ascochyta is one very virulent disease that could benefit from oils added to herbicides. (Photo taken at Birchip, Victoria, in September 1999.)

Slugs are a problem in wet areas

An agronomist friend, Wayne Smith from the South Coast, has been observing (as have I) a gradual increase in slug activity in stubbles. This is particularly true with no-tilled canola crops and in wetter areas. No-till, with surface residue, is keeping the soil moist for longer, and providing food for slugs. No-till is also improving the soil structure on heavy soils and is allowing easier movement of slugs up and down the soil profile.

Slugs are usually only found in clay soils, though we are now seeing them on loamy soils, and they are also eating most crops. The slugs can completely consume plants. With high numbers, re-sowing of the crop is sometimes needed!

Slug damage is severe on canola after pasture (left) compared to canola after sunflower— perhaps the soil was too dry in the autumn!

Some farmers have had to use two or more applications of slug pellets for control. Pellets containing metaldehyde are the cheapest and probably the best pesticide for the job. Pellets contain ~4% metaldehyde and the rest is bran and attractants, like yeast. A light scattering of pellets gives good kills. Pellets should be spread on a calm, moist night, but not when rain is coming.

Metaldehyde works by irritating the slugs on contact or by ingestion. This makes the slugs produce excessive mucus, which leads to dehydration. After eating pellets, they can recover completely if rain re-hydrates them. So the best kills come from spreading pellets on a warm, calm, humid night, followed by a dry, sunny day. A cold morning with heavy dews can also re-hydrate slugs enough to prevent them from dying. *(Information from Wayne's "Agronomic Acumen" Newsletter.)* ■

Grazing warm season grasses and prussic acid!

Prussic acid build-up in warm season grasses does pose some grazing risks for stock. Sorghum and Sudan or Sudax grasses are the ones to watch, whereas millet is considered quite safe. Normal recommendations are that Sudan or sorghum hybrids should be grazed at one metre to minimise prussic acid poisoning.

Avoid grazing stressed forage acid at any stage and don't introduce hungry stock to stressed forage sorghums. Using sulphur lick blocks has been shown to lessen prussic acid problems, and increase livestock production. However, south coast experience over the last two summers suggests the problem is not very common. ■

Radish and no-till: A good mix?

Editor: Farmer and agricultural science graduate from the University of WA, Richard McKenna, sent me this experience his father had—50 years ago!...

Richard said, "In the early 1930's, during the depression, many farmers in Tardun (east of Geraldton) walked off their farms. Ten or fifteen years later, the Christian Brothers re-developed the land and settled orphans on them. My father, who was a child migrant from Ireland at the time, tells this fascinating weed-story."

"In 1946–47 they re-cleared a paddock that had no sign of weeds on it. It had trees re-grown to such an extent that it was cleared and treated like "virgin country". They rolled, burnt, dry ploughed and dry seeded. Dad recalls that the resulting crop was so badly infested with radish that it had to be cut for hay."

"It's interesting to note that it still is a bad radish paddock! As I see it, we can conclude from this story that with the ultimate no-till, the radish ceased to germinate and grow, (helped by shading from the regenerating scrub no doubt) and that the life expectancy of buried radish seed is long indeed." ■

Beware of P deficiency in gravels

In high reactive iron soils, throughout WA, farmers have observed poor wheat vigour with no-till. Some farmers who have observed the problem include the Snookes from Meckering, Boyles at York and Jim West at Kalgarin. The Snookes did some tillage in a trial and observed no benefit.

Snooke's double seeding with double P in the foreground on high fixing soils.

It appears the 20–25 units of P are needed on these soils. Post seeding P is likely to be of only small benefit, as it is needed early in the plant's life. This problem might be worse with no-till where pastures are topdressed with P the year before cropping. ■

Green manuring and summer weeds?

There is lots of interest in green or brown manuring at the moment. It offers a much needed break from selective herbicide use and has the potential to adds lots of N. It's good that AGWEST Geraldton have a GRDC project which is just starting to explore this. However, there is also some eastern states work being done (see inside).

Bill Bowden from AGWEST dug the following data up for us...

In the early '80s, Adrian Reincke did three residue management trials on light land which included a treatment involving ploughing in lupins at flowering. In the second year the plots were cropped to wheat and N rates were applied in the buffers.

Sorghum grown at Esperance 12 months ago.

AGWEST's long-term tillage by weed trial at Avondale where no-till is on 180 mm row spacings, still has lots of weeds. This year effects of tillage on weed numbers is small.

Trial Location	Dowerin	Newdegate	East Hyden
Tops N (kgN/ha) ploughed in	112	91	102
Residue N (kgN/ha) after harvest	65	36	30
Mineral N (seeding) ploughed in	39	66	35
Mineral N (seeding) spray, left	15	53	25
Mineral N (seeding) harvested	8	39	12
Wheat (t/ha) ploughed in	2.0	3.0	2.7
Wheat (t/ha) spray, left	1.3	3.1	2.2
Wheat (t/ha) harvested	1.9	2.4	1.6
Wheat (t/ha) buffer, 0 kgN/ha	1.2	2.0	1.0
Wheat (t/ha) buffer, 15 kgN/ha	1.5	2.4	1.2
Wheat (t/ha) buffer, 30 kgN/ha	1.8	2.6	1.3
Wheat (t/ha) buffer, 42 kgN/ha	1.8	2.6	1.5
Wheat (t/ha) buffer, 80 kgN/ha	1.9	2.5	1.5

The 'tops' and 'harvested' refers to the first year lupin crop. Note that the yield response to N on the buffers plateaus below the yield of the green manure plots, indicating either a fallowing effect or an effect of the rate of N supply from the legume differing markedly from the rate from the fertiliser N. ■

Autumn tickle—the downsides!

There is no doubt that an autumn tickle is often needed when sowing into a grassy pasture. Many other situations may not be so straightforward. Last autumn, the benefits of autumn tickling were regularly espoused on the radio from some Merredin trial work. Farmers who have been no-tilling and leaving weed seeds on the surface for several years may come unstuck with the tickle approach.

I remember Canadian no-tiller Art Lowe, south of Brandon, Manitoba, who decided to cultivate to kill a tough broadleaf weed. After 20 years of no-tilling, and very few wild oats in-crop, Art stimulated thousands of wild oats/m2—it was beyond his belief!

Similarly, tillage at Esperance after 8 years of no-till has seen a massive and sustained germination of ryegrass throughout this year. Steve and Dave Marshall have needed to adopt raised beds in their wet Esperance farm. I'm not convinced that autumn tickles are all that funny for long-term no-tillers!

Likewise, at Birchip field day site in Victoria, tillage has created much weed activity. The more tillage, the more weeds (see photo below). At the herbicide resistance weeds site at St Arnaud in Victoria, the Birchip Cropping Group have stimulated more in-crop weeds with an autumn tickle than without one. A farmer on the red Avon Valley soils said recently: "My neighbour cultivates 5–8 times and still loses crops to ryegrass—he doesn't spray!" ■

Autumn tickling, by creating raised bed at Esperance, has caused extensive ryegrass germinations.

Discs reduce ryegrass down south

There can be no doubt in anyone's mind that zero-tillage with discs reduces ryegrass populations on the South Coast. In August, 70 people at a WANTFA field day shared in a fascinating open discussion. About seven farmers who have been zero-tilling for 7–8 years openly declared before their neighbours and friends that ryegrass is not a concern to them. "It falls out without tillage!", they said.

This certainly fits the adage "what do you do with sleeping dogs—stir them up and shoot them, or let them lie?" However, I wish it was so clear cut for the whole state. I know of two other farmers in the wheatbelt who have been zero-tilling for 5–6 years and their observations are not so positive. However, David Brindall from Mingenew said in the November '98 Newsletter that he is also seeing less ryegrass. ■

Ryegrass resistance to glyphosate—single or multiple gene?

Professor Jonathan Gressel from Israel visited and spoke to about 60 people at Muresk on 30th August. Sorry, it was not so widely advertised. The story he gave was similar to that which he delivered two year ago (featured in the November '97 WANTFA Newsletter). In brief, he suspects that ryegrass resistance is polygenic and ryegrass is gradually evolving resistance to higher rates. Jonny uses computer models, based on the work of South Australian researcher Dr Ian Heap.

We don't know if Jonny is right, and nor does he. Local herbicide resistance authorities appear not to have warmed to his suggestion. At the '1998 February Crop Updates', Professor Steve Powles suggested that he would know whether resistance was single gene or not by September 1998. We were hoping that some data would have been presented at Muresk on 30th August 1999 to update us on this issue.

I believe that the issue is very important! If Jonny is right, then those of you who do not use Spray Seed but just Roundup, will need to use a much higher rate that you normally do, perhaps once in three years. A scary thought! ■

Bees for sunflowers

Sunflowers need bees to pollinate them. Failure of some sunflowers last year may not just have been to Rutherglen Bug. They may also have been due to poor pollination, which is a common problem worldwide—so give your local bee keeper a call! I think it could make his day—and your crop. ■

Apology to Irwin farmer

In the last issue of the Newsletter, I mistakenly gave wrong details about the eroded paddock on the Irwin river flat. The paddock was cultivated with a scarifier to 2.5 inches, and not deeper as stated. My apologies for the mistake! Ed. ■

President's Report

Geoffrey Marshall, Hyden (08) 9880 0018, fax 38

Harvest is either in full swing or very close to it. Some farmers with swathing and from northern areas have been in harvest mode for a few weeks now. I wish you all pleasant surprises as you progress through your various crops, and that harvest weather is kind to you.

Another year draws to a close and Christmas is almost with us. Before we complete the year, may I suggest we have some important cropping details to record, and it can be done in a number of ways, for each paddock on our property. I'm sure it's worth reflecting on:

1. How good were we with our seeding dates, crop type, varieties, disease, insects and weeds?
2. Weed maps! Do we have a plan showing our problem weeds and any changes to last year?
3. Stubble height and spreading for this harvest to make next seeding a well-prepared event.
4. Rotations, rotations —are we winning or losing the battle? If we are losing the battle we need to change at least one thing, be radical and consider every possibility for that paddock.

Warm season crops

Throughout the year, a huge amount of interest has developed for trying these crops for a number of reasons. Using excess water in the soil profile appears the most obvious reason and, by now, perhaps thousands of hectares of sorghum, sunflower and millet have been seeded in WA this year.

There are a number of shared seeding efforts, with trials and comparisons, being conducted across the state. This will give us all valuable information on these crops. Also, how the subsequent winter crops perform following the previous warm season crops should be very interesting. May I encourage anyone to report your results to a committee person or direct to Bill Crabtree?

Professor Dwayne Beck

Dwayne will be a keynote speaker, along with an excellent group of researchers and farmers, for our 2000 Annual Conference. There are more details on the next page. Key dates are:

- Monday 28th February at Geraldton,
- Wednesday 1st March at Katanning,
- Friday 3rd March at Esperance and
- Tuesday 7–8th March at Muresk, Northam.

Meckering R&D Site

There is much potential for this site and many people now understand some of the opportunities and excitement this site will generate. This year (1999) was a set-up year, and a full trial program starts next year. To assist with good industry cooperation, about sixty people (by invitation) attended a field day on the 24th September. The limited number allowed for one group to move around the site, enjoy a lot of interaction, and be a small-scale test run for next year.

A key ingredient throughout Australia, for this type of trial site to be really successful, is to have an enthusiastic local group involved. Our thanks to the Meenaar Group for their generosity (BBQ and drinks) and partnership. WANTFA also welcomes any other farming group to provide us with trial suggestions. Issues that you think are important to high yield sustainable agriculture can be tested at this site—we'd love your input!

Geoffrey Marshall observes the increased height of the no-tilled crop on the right compared to the conventionally cultivated comparison on the left. This is part of a large systems trial at Birchip in Victoria.

A month ago, a group of six, representing the R&D subcommittee (Geoff Fosbery, Peter Burgess, Bill Crabtree, Colin Pearse, Ross Pearse and myself), flew to Melbourne and drove to Birchip to examine how their large Field Day is run. We then went to Horsham, the Postlethwaite's, Robert Ruwoldt's and more. A strenuous and exciting six days and what a group to travel with! Colin and Ross travelled on to SA to experience the Hart Field Day (thanks to SANTFA for your hospitality). This visit was a fact-finding one and was funded by GRDC with assistance from Progress Rural (a Monty House initiative and supported by AGWEST Farm Business Development).

August Field Days

There was a change of style this year, using a large bus. Thanks to CASE IH for your sponsorship. The northern tour attracted 500 people—sorry to the Yuna folks whom we had to leave early to get the bus back to York. The southern tour attracted about 250 people. From the field days we have received some excellent feedback and would welcome any more suggestions, as changes will be made next year to use the bus more fully. The interaction, numbers attending and general attitude to these days has been terrific and this really encourages WANTFA to repeat similar events for next year. The southern field days included Claying Seminars with Clem Obst, Melissa Cann and Rob Hetherington featuring—thanks!

Muresk Honours Scholarship

Thanks to Monty House, the Minister for Primary Industries, who has allocated funding to Lisa Leavers, WANTFA's Muresk Honours Scholarship recipient. Lisa's project is investigating the fate of ryegrass seed dumped in chaff heaps by grazing and burning. We look forward to helpful results coming from Lisa's project.

WANTFA Annual Conference 2000

When?

March 7–8, 2000

Where?

The WANTFA Annual Conference is at 4 locations this year, including Pre-conferences at:

- Geraldton on the 28th February
- Katanning on the 1st March
- Esperance on the 3rd March.

The big two-day Conference will be 7–8th March, 2000 at Muresk.

Speakers

Lots of excellent speakers, including:

- Prof. Dwayne Beck (South Dakota) —a spectacular communicator…

- Prof. Jim Pratley (NSW) —recognised authority on weeds…

- Dr Nigel Wilhelm (SA)—from the SA Research & Development Institute…

- Dr Damian Heenan from NSW Agriculture…

plus, several AGWEST staff, several private consultants and researchers and many excellent local farmers.

Register Now!

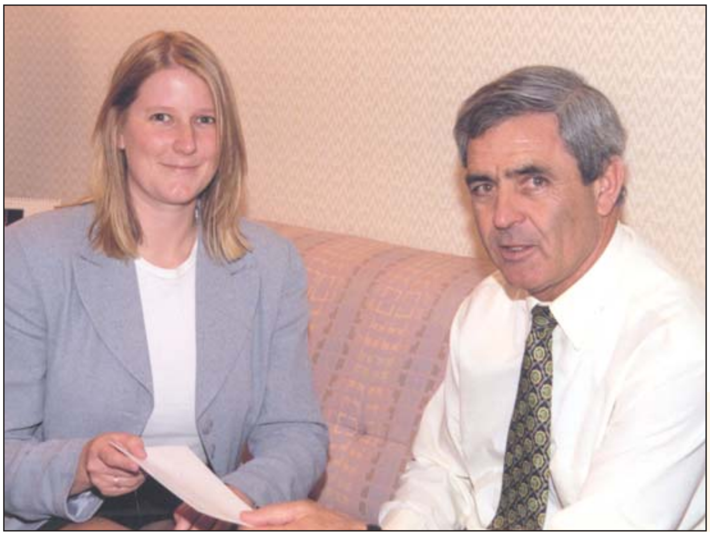
Register before 1st January 2000 and get your Early bird discount.

More Information?

See the next edition of the Newsletter for full program, sponsorship and cost details and Conference registration forms.

Enquiries, phone: John Duff

(08) 9277 9922



Lisa Leavers receives funds from Primary Industries Minister Monty House earlier this year.

Memberships

Numbers have continued to grow at a steady rate, and this has required a more extensive database run by Mary Schick (based at consultant John Duff's office). We value you, our members, and your feedback to ensure that this database is effective and up to date. Call Mary on (08) 9277 9922 with any questions about membership or fees. The GST component will have to be included in the 2000 renewals and will be calculated as from the 1st July.

As I write this, it is raining—I hope this is positive for all farmers, as it is early October. I wish you all a wonderful harvest and a Happy Christmas and New Year period. Welcome 2000!

Thanks partner!

WANTFA thanks the following for their assistance in the 1999 growing season:

What for	Who
Assistance with field days.	Alex Gartmann (Victoria Plains), Mike Doherty (TopCrop Mullewa), Pete McCracken, David Rogers (Wesfarmers-Dalgety), Jeremy Lemon (AGWEST), Tom Lewis, Chris Pinkney (IAMA), Ben Hatter (LCDC), Clem Obst and Melissa Cann (PIRSA), Case IH (the bus).
Companies or people who assisted our trials program.	AgriTech Crop Research, Nufarm, CSBP (tissue tests), United Farmers, Hans Schoof, Pivot (UAN), Novartis (Logran), AgLime, Hollet Brothers from Cunderdin (applied lime), Elders (seed), CLIMA (trial), UWA (acidity) and Simon Teakle (student).
Help with Meckering R&D site.	GRDC, WANTFA's Meckering Sub-committee, Colin Pearse (owner-partnership), Birchip Cropping Group (time & assistance), Progress Rural (some travel funds to Birchip), Bill Bowden (sampling and analysing N trial).
Claying trials at Esperance	Esperance Laser Leveling, John Luberda, Steve Mitchell, Rob Hetherington, Andrea Hills and Matthew Jones.
Funding projects	GRDC (Scientific Officer and Meckering R&D), NHT (salinity demonstration site), Primary Industries Minister Monty House (Lisa Leavers - Muresk Honours, Dwayne Beck's travel, Geoffrey Marshall's trip to no-till conferences in the USA in January 2000).
Seminar help	Wayne Smith (for paying for Jeff Esdaile's travel to speak on warm season crops), WA Lucerne Growers Assoc., Jackie Bucat (Screen) and Rob Hetherington.

WANTFA Annual Conference 7–8th March at Muresk

John Duff, Consultant, Belmont (08) 9277 9922

The WANTFA 2000 Annual Conference will include pre-conference seminars to be held in Geraldton on Monday 28th of February, Katanning on Wednesday 1st March and Esperance on Friday 3rd of March. The main conference will be held at the Muresk Institute of Agriculture in Northam on the 7th and 8th of March.

The 1999 event was most successful , with over 700 people attending. The overwhelming majority of feedback was positive. This year's event will build on that strong foundation. "High Yield Sustainable Agriculture into the Next Century" is the central theme for the 2000 conference.

Professor Dwayne Beck

Leading crop rotations researcher Professor Dwayne Beck spoke at many WANTFA Seminars in February 1996 and he sparked a lot of interest in warm season crops. He returns to WA and will join a selected group of leading local and interstate speakers.

WANTFA President Geoffrey Marshall said, "We are so fortunate to have a speaker of Dwayne's calibre available to share with us his knowledge and experience in intensity and diversity of no-till cropping systems. The 1998 WANTFA study tour spent two fantastic days with Dwayne and he is such a spectacular communicator, with a timely message for us all. If no-till rotations with high water use and reduced salinisation is on your agenda, then Dwayne will not disappoint."

Dwayne will speculate on more suitable crop types for WA rotations—such as cold-hardy sorghums from Africa or China.

Professor Dwayne Beck from South Dakota.

Professor Jim Pratley

Internationally recognised Australian authority on weeds Professor Jim Pratley, from Charles Sturt University, NSW, will also speak at the conference. Jim was the first scientist to document glyphosate resistance in ryegrass and has some valuable insights in ryegrass management. He will also present data on ryegrass digestion by sheep and allelopathic effects (see the first story on front page).

Professor Jim Pratley.

Geoff Fosbery

Peter Burgess

Other speakers include Professor Bob Gilkes from the University of WA, Geoff Fosbery, Principal consultant at Farm Focus in Northam, Wayne Smith from Agronomic Acumen in Albany, Dr Nigel Wilhelm from the SA Research & Development Institute, Peter Burgess from AgriTech Crop Research, and Damian Heenan from NSW Agriculture. All these speakers have excellent messages to present.

Geoff and Wayne are leading edge extension agronomists who deal with complex farm system issues. Damian has been conducting long term no-till trials, with lime, burning, tillage and rotations and has collected some invaluable data over many years.

Dr Damian Heenan will share deep insights into changes with tillage systems.

Registration

Conference registration forms will be available in the next edition of the Newsletter when full program, sponsorship and cost details will be announced. Watch this space. ■

Summer Crops Offer a New Approach

Laurentiu (Laurie) Spatariu, Perth (08) 9402 3485 p/f

I have worked professionally on sunflowers, and other warm season crops, all over the world, for almost twenty years. I have worked in Pakistan, Ghana, California and, in my native country of Romania, where I studied and worked as a Senior Agronomist in Charge of a State Agricultural Enterprise. About 12 years ago I escaped an uncomfortable regime, and have been working as a quarantine Officer with Agriculture Western Australia for the last 10 years.

Laurie talks to other agriculturists about his research work.

Last year I read an article in the Countryman where Tony Seymour was working with warm season crops in WA (see July 1998 newsletter). I phoned Tony and expressed some optimism for the potential of these crops in the WA environment. I then visited his trials at Colin Steddy's farm in Narembeen. I was pleased to see the interest and professional effort made by Tony with sunflower, sorghum, corn and safflower.

We need to remember that positive results never come overnight and sometimes can take years—however, this is a good start. In my first year on a Sunflower Seed Multiplication Program in Pakistan my first yield was 0.0 t/ha! Armyworm destroyed 4 ha of sunflowers in less than two days! The same year, another 4 ha had poor pollination, due to not having enough bees. The result was 500 kg/ha instead of 2,500 kg/ha.

I can see there have been good results with some summer crops like safflower, sorghum and coriander in the area. It will be important to research the best practice for optimum time of sowing, plant populations, fertilisers, best crop rotations and selection of species for our technology and soil types and climates within WA.

While in Pakistan on the sunflower project, I had to establish the sunflower seed production scheme and crop technol-

Armyworm devastated this crop of sunflowers.

ogy specific for the Punjab area in two years (which was 4 cropping seasons). It was a difficult task considering our first crops loss—with poor yields! From the second crop we collected some excellent information. I collected data from different hybrids, including Cargill and Sun-Cross from Australia. None of the hybrids or varieties were physiologically and productively useful.

I then collected two local varieties and undertook a rigorous mass selection program. From the 4,100 plants tested, 27 of one variety and 14 from the other, were selected. These plants were then sown for seed multiplication and the results were spectacular. We also effectively selected for sunflower heads that faced the ground at maturity, this ensured that the birds were unable to eat many of the seeds from the sunflower head.

I was asked to extend my contract in Pakistan but for family reasons I refused. In closing I encourage you in your quest for the right varieties to grow in WA and look forward to seeing the results! ■

Sunflowers selected for bird-eating resistance—the heads face down!

No-Till Systems and Y2k

Kevin Bligh, Committee (08) 97557589, walburra@netserv,net.au

No-till systems demonstrate the fundamental ecological principle, that everything is connected to everything else. Scientific research, on the other hand, necessarily has to isolate variables—to put on blinkers—in order to study effects of one variable on another.

That is not the real world! And problems can arise when it is taken as the real world! The most immediate of such looming problems is Y2k, the so-called Millennium Bug. There was nothing unpredictable about the turn of the century when the offending computer programs were written, and solid-state chips manufactured (up until the '90s, no less). Nobody was re-integrating the parts into the whole system!

The likely effects are inherently unpredictable. However, a few economists and researchers have been making interesting statements. Dr Ed Yardeni, Chief Economist and Global Investment Strategist of Deutsche Bank said on 10 August after two years study, that he still considers a global recession caused by Y2k a 70% probability. Other economists appear more complacent.

Internationally respected Y2k computer consultant Peter de Jager said in April, that he certainly would not be flying into Moscow Airport, or airports in many less-developed countries, in the New Year. The main problem is air traffic control.

You then have to wonder what the effects on shipping into our major grain markets may be. Most nervousness in the US seems to be about the Y2k preparedness of Russia, China, Italy and the less-developed Middle-East oil and other countries.

A leaked US Navy report also suggests that 126 US cities, including New York, may be without electricity, gas, water or sewerage. Governmental assurances, however, seem to be adding to people's natural denial of Y2k effects, making panic-buying problems less likely.

What are the implications for our cropping decisions next year? The situation may well become fluid! If importers of Australian grain have problems, markets may swing, causing decision-making quandaries for crop rotations the year after as well.

It may even be, like in the 1976 drought in WA's Northern Agricultural Region, that it might be better not to put in the full cropping program next year. Questions about stock or, perhaps, chemical fallow then come up. Every farm will be different.

If our oil supplies are disrupted, presumably Government will give priority to agriculture. Still if, like me, you want to play safe—and can afford to forego the interest—you may consider filling up on-farm fuel storage before the end of the year.

If some herbicides are unavailable next seeding, weed-control strategies may have to be re-thought. After building up soil structure since you began no-tilling, it would be a shame if disc ploughs had to be hauled out, or wide points put on again.

Even a single full cut-out-point tillage reduces rainfall infiltration to closer to three tillage cultivations. And on sandy soil, you have to be careful to leave as much stubble as you can on the surface, to reduce wind erosion.

On available evidence, the year 2000 is likely to be different. We can only do what we can to ride out this first unavoidable problem caused by the short-sightedness of looking at things in isolation and, effectively, trying to contradict the real world.

Think of what the trillions that have had to be spent on Y2k—and still have to be—could have done if society operated on a systems basis. Let's get on with investigating warm-season crops, to increase crop yields and profitably reduce rates of salinisation.

On a recent trip through southern France, I swore I'd scream if I saw another crop of sunflowers! If they're growing them in a similar climate, why can't we? They're even growing forage maize in Ireland—known more for its mild wet than warm summers! ■

Herbicide Resistant Weeds in WA

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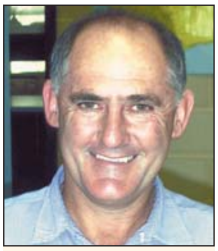
Professor Steve Powles

The WA broadacre grain cropping industry is a great success story. Total grain production (dominated by wheat) has almost doubled over the past decade. In 1997–98, grain crops contributed $2.7 billion of the $4.1 billion agricultural production. The doubling of grain production over the past decade is due to intensified cropping (at the expense of livestock) and increased grain yield per hectare.

There are a number of factors contributing to this steady rise, including plant breeding, sound farming system/rotations, favourable seasons, large farm enterprises, reduced tillage and herbicide technology. The widespread adoption of less tillage, is one major factor contributing to the productivity and sustainability of WA grain cropping.

A significant challenge to the success of no-till farming systems is the control of weeds. Excellent weed control is being achieved due to the availability of a range of efficient knockdown and selective herbicides. Herbicides, by substituting for the plough, enable early seeding, intensive cropping and no-till systems.

However, major weed species are developing resistance to herbicides in WA. Grain farmers are increasingly reporting weed control failures due to herbicide resistance. Resistance is by far the biggest problem in annual ryegrass and is also emerging in wild radish.

Ryegrass in Australia - world's worst herbicide resistance

Unfortunately, ryegrass that develops resistance to one herbicide can exhibit multiple herbicide resistance, often to a wide range of herbicides. In the most severe cases, ryegrass can be simultaneously resistant to a wide range of herbicides from Groups A, B, C and D (these include triazines and trifluralin).

Ryegrass was first reported as developing triazine resistance in 1991 in Australia, and trifluralin (Group D) resistance in 1995. With the rapid increase in triazine resistant canola in WA there is going to be much more triazine resistant ryegrass and other triazine resistant weeds. In 1998, I found six ryegrass populations in WA canola paddocks that were not killed by 6 L/ha of atrazine! Equally, with increasing reliance on trifluralin there are going to be trifluralin resistant ryegrass populations. Many of these populations will have multiple resistance to other herbicides and will be a major challenge to intensive cropping.

Resistant wild radish in WA

Work by Abul Hashem of AGWEST at Merredin has documented some 36 WA wild radish populations as resistant to Group B herbicides (products such as Glean, Ally, Logran, Broadstrike, Eclipse, Odyssey, Spinnaker). Given the large usage of Group B herbicides in cropping there can be no doubt that Group B resistant weeds, especially wild radish and ryegrass will continue to increase. Recently, atrazine resistant wild radish has been shown in WA.

Weeds resistant to the knockdown herbicides

Much of the success of reduced tillage cropping in WA is due to the excellent knockdown weed control being achieved with glyphosate or paraquat. It is important that these herbicides continue to work effectively if we are to continue the success story with no-tillage grain cropping in WA. Weeds can develop glyphosate and paraquat resistance.

In South Australia, barley grass has developed paraquat resistance on two paddocks that were intensively cropped with no-tillage and persistent paraquat usage for knockdown weed control. In a NSW orchard and a Victorian intensively cropped paddock, ryegrass populations have developed resistance to glyphosate after persistent usage. Common factors are intensive cropping, knife-point seeding without cultivation and persistent usage of the one knockdown herbicide. In WA grain cropping there are, as yet, no confirmed cases of paraquat or glyphosate resistance. Our objective should be to maintain this situation!

WA grain croppers will continue to be reliant on glyphosate and paraquat for knockdown weed control before seeding and for crop and pasture-topping. As resistance genes to glyphosate or paraquat are rare in plant populations these herbicides should continue to work well for the foreseeable future. However, to extend the life of these chemicals, we must reduce our dependence on them. Of course this is easier said than done! One thing that can be done, immediately, is "when on a good thing with one of these chemicals— don't stick to it!" Rotation between these two chemicals is sensible. As with all herbicides, the less often we use them, the longer they will last. Using herbicides as infrequently as possible involves a farming system which involves a variety of methods for weed control. This is termed integrated weed management (IWM).

The Future: Integrated Weed Management

The objective of a WA grain grower should be to preserve the efficacy of the various herbicides available. Herbicides are wonderful tools for weed control with no other technology anywhere as effective in controlling weeds. Yet, herbicides can fail due to resistance when they are used persistently. The challenge for grain growers is to use herbicides sustainably. This paper is not the place to outline in detail the various practices that can be used to minimise the likelihood of resistance. Decisions will come down to an individual paddock and farm basis and will often involve discussion between the grower and adviser. An integrated farming system allows weed control with a range of different techniques and different herbicides. This reduces excessive reliance on any one tool. Some practical options for the WA cropping-focussed farming systems include:

- Delayed seeding date to allow knockdown and/or judicious cultivation before seeding.
- High seeding rates to provide a competitive crop that suppresses weed growth.
- Judicious herbicide usage involving herbicide rotations and not sticking to a good thing.
- Crop and pasture topping when possible to maximise weed seed kill.
- Capturing weed seeds at harvest with chaff-carts, etcetera, to minimise seed return to the paddock.
- Phase farming concepts which enable weed seed kill for at least two years in a non-crop phase.
- Attention to rotations to provide diversity in weed control/herbicide options.
- Judicious use of transgenic (Roundup, Liberty) resistant canola from 2001 onwards.

Relevant Reading

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Liming Sub-surface Acidity Under No-Tillage

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Sub-surface acidity in WA

In 1916 a farmer named Rutherford suggested a lime trial on Wodgil soil, apparently on the diagnosis of poor wheat growth compared to oats. The Wodgil Committee said no, and it was not until the 1980's that the problem was identified as sub-surface acidity.

Soil acidification is a slow and natural part of agriculture. It results from the leaching of nitrate or from the removal of alkalinity in plant products—after plants have fixed N or taken up ammonium based N fertilisers like ammonium sulfate, ammonium phosphate, calcium ammonium nitrate or urea.

Sub-surface acidification has only generally been recognised in the last 10 years as a problem in sandy WA soils, most of which were slightly acidic before clearing. The remedy to sub-soil acidification is also slow. It is important to apply lime before the problem becomes severe, as lime movement is slow. Lime movement is not easily demonstrated in short-term trials.

Surface-applied lime offers the best currently available solution for fixing and preventing sub-surface acidity. (The naturally acidic Wodgil subsoils are a special case in which the whole soil profile is extremely acidic and would require both higher rates of lime and a longer time to ameliorate.)

For each 1 kg of leached nitrate, the calcium carbonate loss is about 3.6 kg. Recent work at CSIRO has shown that, in deep sand and a 500 mm rainfall zone, nitrate losses in a wheat:lupin rotation can be as high as 35 kg N/ha per year. This is equivalent to removing 125 kg/ha lime each year.

Lime movement from old lime trials

In a wheatbelt study of lime trials where lime was applied 2–15 years earlier, we have shown increases in sub-surface pH can occur in sandplain or duplex soils within 4–7 years of applying lime at rates of 2.5-5 t/ha. Lime at 1.0 t/ha had little effect on sub-surface pH, possibly because the lime demand of the topsoil consumed all the lime and prevented the pH from increasing sufficiently to provide a sustained "trickle" of alkalinity into the sub-surface. From theory, lime movement as dissolved alkalinity will only occur if the surface soil pH is greater than 5.5, and would increase 10-fold for each increase of 1 pH unit above this value.

In these trials, the lime had been incorporated with tined scarifiers. From our measurements of undissolved lime at new trials, most of the lime would have remained within the top 5 cm. Compared with no-till, incorporation may give some advantage in getting the lime to dissolve and start moving into the acid sub-surface where it is most needed, but we do not know if there would be a significant delay under no-tillage.

Lime movement: no-till versus scarifier

In two new lime movement trials started in 1998 at Konnongorring, we are comparing the effects of no-tillage and lime incorporation with a full-cut scarifier in the year of application in a wheat-lupin rotation. All seeding for both tillage treatments is with a double disc seeder. *(Editor: WANTFA also has 3 similar long-term trials at Meckering where we are comparing 0, 1, 2 & 4 t/ha with zero-till, no-till, direct drill and direct drill in year one and no-till afterwards.)*

We are also comparing the effects of lime particle size by using limesand "as is" or finely ground to nearly 80% less than 0.045 mm to increase the potential rate of dissolution. The field trials are complemented by laboratory leaching experiments to examine the potential for fine-lime movement and to compare the effects of stubble management and soil type on lime movement.

Lime movement is also being monitored on two nearby farms where lime or dolomite had been incorporated with culti-trash or knife point seeders in replicated test strips under normal farm management. The trials are run in collaboration with AGWEST and CSIRO as part of a GRDC funded soil acidity project. Dr Andrew Rate and Ms Teresa Wozniak, both of UWA, are also involved in the lime movement component of this project.

Side effects of lime

Liming our nutrient deficient soils can expose the crops to Mn, Cu or Zn deficiencies. These elements become less available as the pH increases and will need monitoring for early remedial action. In no-till systems it may be advisable to drill or deep band trace elements in order to avoid the limed surface soil zones where the pH will be highest. Also, some soil active herbicides will breakdown more slowly with high lime applications and may have impacts for the following year's crop.

No Rain = No Summer Crop on Deep Sand

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Background

The northern wheatbelt of WA has recently been a wheat:lupin intensive cropping region, and many farmers now have 100% in crop. The majority of the region comprises of light to medium sandplain soils, much of which is deep, but many water-tables are close to the surface in lower lying areas.

Craig Topham inspects the growing sorghum on Tim Barndon's farm at East Chapman on deep sands.

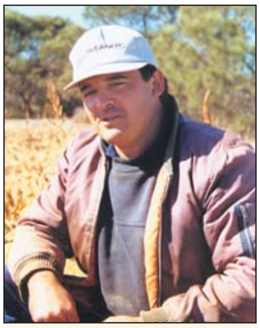
As a result of the narrow cropping rotations, diseases and herbicide resistance are threatening cropping sustainability. The recent introduction of chickpeas and faba beans to the heavy soils and canola on the lighter soils, has diversified rotations in part. The build up of diseases like *sclerotinia* and *rhizoctonia* is reducing production, even with canola and chickpeas in the rotation.

It is hypothesised that if we could introduce warm season crops like sorghum or sunflowers into the rotation, long-term farming systems may be more profitable. These crops would allow for non-selective weed control at a unique time of the year—mid-flowering of weeds!

Through WANTFA, Dr Dwayne Beck of Dakota Lakes Research Station, Pierre, South Dakota visited WA in February 1996. Dwayne sparked much interest in warm season crops for WA. Since then many farmers have experimented with these crops—some with great promise!

Trial program, design and methodology

In 1998 we tested the agronomy of grain sorghum and sunflowers on Tim Barndon's farm at East Chapman. Tim helped us greatly and GRDC partly funded the work through WANTFA.



Tim Barndon kindly assisted in the trials on his farm.

The trial was sown with Agras #1 (17:7:0) at 60 kg/ha and was banded with the seed. Unfortunately this gave some fertiliser toxicity on the sand soil.

We tested four crops (sunflower {Hysun 25}; millet {Shirohie}; and two sorghum's {DK35 and New Nugget}), three seed rates (3, 6 and 9 kg/ha) and two row spacings (36 and 100 cm).

Plant counts were taken 64 days after seeding and the trial was machine harvested on 25th February 1999 at 10 am when the air temperature was 35°C and the moisture content of sunflowers was 4.5% and sorghum was 11.5%.

Soil type, cropping history and rainfall

The site was a deep yellow sandplain (at least 4 m deep) with no gravel and less than 8% clay in the topsoil. The paddock had been continuously no-tilled to wheat:lupins for the previous five years and was sown into a 1997 wheat stubble. At seeding there was 50–60% stubble cover on the soil surface. The region's average rainfall is 387 mm, with most falling in the winter (see table below).

The grain sorghum nearing maturity in February 1999.

Soil temperature and moisture

The site was chemically fallowed through winter with glyphosate and 2,4-D ester 80%. Soil temperature was 22°C at the surface at seeding time. The day temperature during seeding was 31°C, with a rising trend. The table below shows long-term data from Nabawa —10 km away!

Measurement	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mean daily max. temperature (°C)	19.3	22.0	25.0	28.9	31.9	34.1	34.2	32.1
Mean daily min. temperature (°C)	7.5	8.2	10.0	13.3	15.8	17.7	18.3	17.0
Mean daily temperature (°C)	13.4	15.1	17.5	21.1	23.9	25.9	26.3	24.6
Average rain (mm)	65	35	22	11	6	7	12	14
98/99 rainfall	27	6	1	28	0	0	58	
Average daily evaporation (mm)	2.3	3.2	5.4	6.7	9.9	11.5	7.7	8.1

The soil was moist to within 5 cm of the surface at sowing and crop seeds were sown into this moist band at 7 cm depth on the 16th of September, 1998. Prior to seeding, 354 mm of rain had fallen. Most of this would have leached during winter. The week prior to sowing 10.4 mm of rain fell and 1 mm fell the day after sowing, with 14 mm falling the following week. The crop received 52 mm of rainfall from seeding until being harvested.

Results and discussion

Grain yields of all crops were very poor, which contrasts with previous grain yields on the same farm (on heavier soil types) where sorghum has yielded up to 1 t/ha. The dry summer did not help production. There was only 52 mm of rain while the crop was growing (half of the long-term district average of 93 mm for September—February). After harvest, in March, 58 mm of rain fell and the sorghum regrew from the base with vigour. However, this regrowth was not harvested.

The deep sandy soil has insufficient water holding capacity to grow warm season crops for grain production, unless there is significant rainfall after these crops are sown. Lots of rain prior to seeding is of little use to the crop on such leaching soils.

The millet was easily established and was hardy but was completely grazed by rabbits and kangaroos. No vermin ate the sorghum.

Heavier soils yielded a reasonable grain sorghum crop on Tim's farm the year before.

The surface dried quickly on the sands, which further reduced emergence. Soils with greater stubble cover and organic matter will dry more slowly and allow crop germination. Fertiliser toxicity occurred, particularly on water repellent soils, and ensured that the wide rows suffered most with poor plant counts. If N is to be applied at seeding (which is recommended) then seed and fertiliser separation is essential.

For sorghum, the higher yield from the New Nugget over the DK35 is likely to be due its quicker maturity and greater tillering. The sorghum showed N deficiency symptoms at booting.

With sunflowers, the plants that germinated grew well and produced large, well-formed seed heads. We observed, but did not measure, that where sunflower and sorghum plants were grown in close proximity to other plants, their growth was inhibited.

Plot No.	Crop type	Row space (cm)	Seeding rate (kg/ha)	Plant counts (pl/m2)	Seeds established (%)	Grain yield (kg/ha)
1	Hysun 25	100	3	1.8	28	–
2		100	6	2.3	18	–
3		100	9	2.8	14	–
4	Millet	100	10	4.0	15	–
5	New Nugget	100	3	2.5	26	134
6		100	6	3.3	17	164
7		100	9	4.8	17	154
8	DK35	100	3	4.5	47	103
9		100	6	10.7	56	60
10		100	9	9.5	33	54
11	DK35	36	3	7.1	75	150
12		36	6	5.7	30	160
13		36	9	10.0	35	130
14	New Nugget	36	3	5.0	53	148
15		36	6	11.4	60	165
16		36	9	14.3	50	188
17	Millet	36	10	24.2	93	–
18	Hysun 25	36	3	6.4	98	58
19		36	6	7.1	55	92
20		36	9	9.3	48	125

Conclusion

At least 200 and 500 kg/ha of grain sorghum and sunflowers respectively are needed to ensure farmers break even with warm season crops. In dry summers and on deep sands of East Chapman, at least average summer rainfall is needed to grow break-even crops. Greater success is likely on the heavier soils.

This work has highlighted the importance of avoiding fertiliser toxicity, especially on wide row spacings and in water repellent soils. Because of these complications, it is difficult to make conclusions on row spacings and seeding rates from this work. New Nugget sorghum yielded better with increasing plant density—contrasting with DK35. ■

Air Induction Spray Nozzles - Do They Really Work?

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Many farmers have bought TurboDrop® air induction nozzles in order to reduce spray vapour drift. These nozzles increase droplet size and therefore reduce target coverage. The manufacturers claim the nozzles produce droplets that have air bubbles trapped inside them. The droplets then reportedly shatter on impact with the target, achieving adequate coverage. However, feedback from farmers about herbicide efficacy encouraged us to investigate these nozzles.

Crop Care Australasia performed three fully replicated field trials to evaluate the efficacy of the TurboDrop® air induction nozzles. The TurboDrop® nozzles were compared with equivalent TeeJet® nozzles (standard flat fan) with three different types of herbicides, varying in their degree of systemic movement within the plant. The herbicides used were: Touchdown® Broadacre (highly systemic), Achieve® WG (moderately systemic) and Spray•Seed® 250 (non-systemic, contact only).

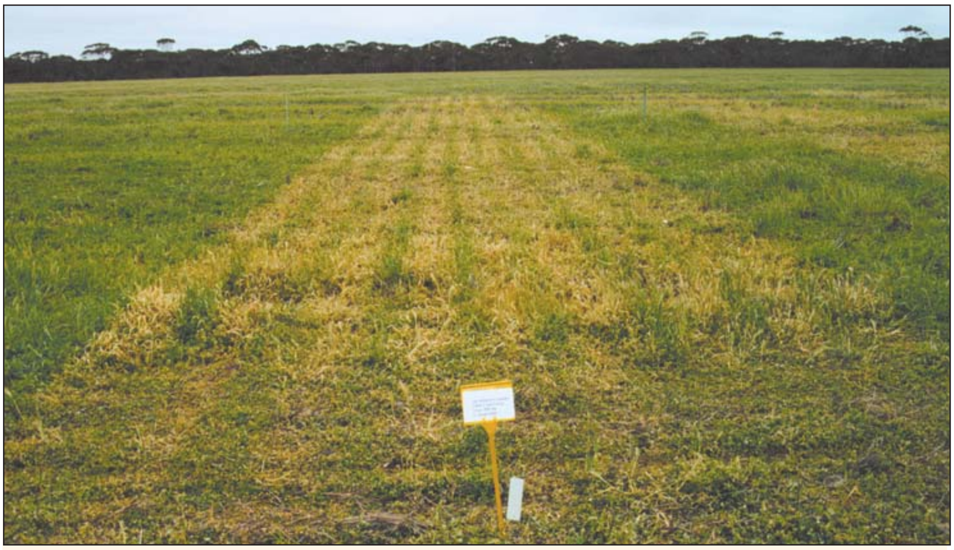
Good coverage is important for all herbicides, but is particularly so for contact herbicides.

The Touchdown (at 1.25 L/ha) and Spray•Seed (at 2 L/ha) tests were done in old pasture in mid-August on ryegrass, silver grass, and capeweed. The Achieve was applied to wheat infested with wild oats at 250 g/ha plus 0.75% of Supercharge®.

Results and Discussion

The TurboDrop gave poor weed control at the lower pressure of 300 kPa – regardless of water volume. This was largely due to there being inadequate pressure available to form a full flat fan. This resulted in missed strips between jets and poor penetration into the bulk of the target. Increasing the pressure to 600 kPa was not a practical option at 30 L/ha total spray volume because of the excessive ground speed which would be required.

By increasing the total spray volume to 50 L/ha and increasing the spray pressure to 600 kPa, the effectiveness of the TurboDrop was increased to the level provided by the standard flat fan. Although, with the less mobile products, Achieve WG and especially Spray•Seed, their efficacy was still reduced – particularly with grass control, where the grasses are a fine vertical target and are harder to cover compared with flat broad-leafed weeds. It is possible that the large droplets, produced by an air induction nozzle, may miss small 2-leaf grasses altogether.



Turbo jet nozzles at 3 kPa show stripping

Percentage control of target weed - all nozzles 110-015.

Product and Target	30 L/ha Spray Volume			50 L/ha Spray Volume		
	300 kPa		600 kPa	300 kPa		600 kPa
	TeeJet	TurboDrop	TurboDrop	TeeJet	TurboDrop	TurboDrop
Touchdown - annual grasses	82	47	N/A	92	62	95
Touchdown - broad-leaf	93	77	N/A	97	67	97
Spray•Seed - annual grasses	68	45	N/A	96	52	88
Achieve WG - wild oats	88	67	N/A	98	62	96

N/A: Not applicable due to excessive ground speed required.

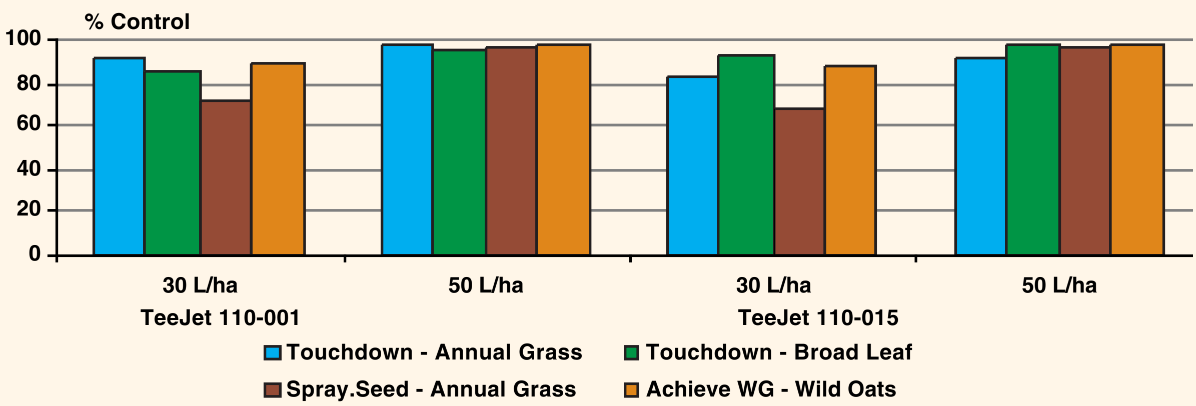
These trials were conducted with both 001 and 015 spray nozzles at both 30 and 50 L/ha. This makes for an interesting comparison of the importance of Total Spray Volume with the different product types. All products performed better with higher water volumes. Large increases occurred with Achieve and Spray•Seed.

Conclusions

Air induction nozzles do reduce the number of fine driftable droplets produced. However, they may not provide good weed control in commonly used situations. The large droplets produced require high spray pressures to achieve a full flat fan double overlap. A minimum operating pressure of 500 kPa is required to achieve this, and few boomsprays are capable of producing this amount of pressure. These large droplets do not give coverage or weed control equivalent to that of standard flat fan nozzles with the less systemic products like Spray•Seed and Buctril MA.

Farmers can adopt other methods to minimise spray drift. These include; higher spray volumes and lower operating pressures (50 to 100 L/ha at 250 kPa which reduces fine driftable droplets), correct boom calibration and operating height and avoiding spraying in very still or windy conditions.

While it is important to manage spray drift, herbicide efficacy should not be jeopardised.



Sustainable Farming Systems in Victoria

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Yvonne Postlethwaite

The sustainability of dryland farming systems is dependent on many factors. Tillage and residue burning systems degrade soil structure, while livestock and heavy machinery traffic compact and seal the soil surface, reducing the infiltration of water and increasing surface run-off. This leads to pollution of rivers and streams by soil and nutrients.

Alternatively, farming systems can increase soil organic matter with pasture or with residue retention. These systems:

- improve soil structure
- prevent soil surface sealing
- increase water infiltration and retention
- reduce run-off into rivers and streams
- reduce drainage to the watertable
- eliminate wind and water erosion.

Such systems increase yield and water use efficiency and are arguably sustainable.

Another system uses phase farming techniques that alternate between phases of cropping using conservation farming techniques and phases of pasture for livestock production. Although wool production is not profitable at present, prime lamb production can be. However, compaction caused by grazing livestock is still a problem. In addition, in the Wimmera region, pasture establishment and continuous availability of feed for livestock is a concern with opening rains frequently occurring in May.

Background

Before 1982, Cloverlea Farms was a mixed farm using conventional cropping systems of a cultivated fallow intended to improve water conservation, nitrification of soil organic matter and weed control. Stubble was burnt before cultivating due to stubble handling problems. We thought that burning stubble killed soil-borne pathogens and weed seeds. This regular removal of organic matter, plus rapid mineralisation of stored soil organic nitrogen through tillage, added to the loss of soil fertility and was not sustainable.

The soils on Cloverlea farms are Wimmera self-mulching grey/brown sodic clays and duplex red-brown earths. Tillage degraded both these soil types. Conventional tillage combined with stubble burning caused soil degradation by reducing the soil's organic matter levels. Soil structural breakdown led to hard-setting, waterlogging and compaction.

These factors caused soil and nutrient pollution. Cultivated fallow was an inefficient use of rainfall. This low crop water use efficiency meant unused water drained through to the water table. At that time, it was thought that reducing tillage would reduce soil degradation. However, the largest loss in soil organic carbon and soil structural degradation occurs with the first tillage operation and then, to a lesser extent, with subsequent tillage.

To minimise soil damage we adopted phase farming. Livestock grazed the pastures for financial benefit during the pasture phase. However, the inability of the pastures to provide sufficient feed for livestock during winter, summer and many autumn seasons necessitated the supplementary feeding of livestock during those periods.

Tillage to release soil nitrogen led to a steady decline of soil fertility. Cut hay increased profitability during the pasture phase but still further reduced the soil's organic matter.

By 1982 it was clear we needed to change our system to increase profitability and water use efficiency in order to be more sustainable. Our wheat yields were rising but our profitability was falling. The water use efficiency was erratic. From 1971–82, livestock produced only 10% of the total farm income from about 50% of total farm area. Contrastingly, grain production gave 90% of total farm income from the remaining 50% farm area.

Increased profitability from livestock was not possible without lot feeding. Doubling livestock numbers would not have improved profitability. Doubling crop area could increase profit but, with conventional cultivated systems, this would further degrade the soil structure. In addition, the removal of the pasture phase associated with livestock production eliminated the soil renovation stage of the conventional mixed farming system.

No-till farming began

In 1983 we began continuous cropping using zero tillage, stubble retention and rotation of a variety of crops. Herbicides controlled the weeds. Improved soil structure achieved soil water conservation for plant use by reducing the water runoff and reducing evaporation. No compaction occurred from livestock and the soil's water storage was 30–50 mm more than before.

Retained residue increased the soil's organic matter. Stubble residue, left standing on the soil surface, eliminated raindrop impact and soil surface sealing, as well as preventing soil erosion by wind or water.

The standing stubble also reduced the phytotoxic effects of incorporated stubble, reduced the tie up of nitrogen and increased numbers of microorganisms. These fed on the residue and released nutrients for subsequent crops. These microorganisms also broke down chemicals reducing the toxic effects on plants.

Postlethwaite's peas, sown in paired rows, look happy in mid-September 1999, but the dry conditions soon after took the shine off them.

Full soil analyses were taken at five-yearly intervals from depth levels of 0–15 cm and 15–60 cm. Each year the soils were analysed in each paddock for nitrate nitrogen. Annual paddock nutrient balances calculated the nutrients removed with the grain. The use of a fertiliser calculator ensured the replacement of these nutrients with the next crop.

At present, noodle wheat is grown that requires a specific protein level. The fertiliser is tailored to the crop, as well as to the available soil water, so that fertiliser use matches the season thus eliminating water and fertiliser drainage to the water table.

Crop rotation and selection

Crop rotation and selection are major factors in any cropping system for control of diseases and weeds. Cloverlea Farms has no fixed rotation although, from 1986–97, rotations included four cereals, five legumes and two oilseed crops in most paddocks.

Below: Some members of the Meckering R&D sub-committee inspect the Postlethwaite's wide row spacing crops in mid-September 1999.

Crop rotations are now more intensive due to more available soil water with this system. The rotation of winter cereals and broadleaf crops with summer cereals and broadleaf crops gives a diversity of plant types, sowing dates and harvest periods.

Crop rotations plus stubble retention reduces cereal root diseases such as rhizoctonia, take-all and cereal cyst nematode. The selection of resistant crop varieties has helped reduce diseases such as stripe rust in wheat and blackleg in canola.

Weed control is a major factor in crop production. Conventional farming uses tillage, rotation, chemicals and grazing livestock for control of weeds. In contrast, no-till farming uses only crop rotations and chemicals for control of weeds. Zero tillage leaves weed seeds on the soil surface instead of burying them. In addition, increased cropping intensity with a continuous cropping system allows for increased competition between crops and weeds.

Herbicide resistance in weeds is becoming an increasing problem throughout Australia with both conventional and conservation farming systems. New options are necessary for control of these weeds before other methods fail. One such option is to grow sorghum in rotation with winter crops to control winter weeds.

Late sown chickpeas on wide rows, both tools reduce weeds and seem to reduce Ascochyta.

Although very little sorghum grows in Victoria, and nearly all that with irrigation, the increased soil water available through no-till and stubble retention makes sorghum production an option. On Cloverlea Farms, grain sorghum provides the opportunity for improving productivity, profitability and, ultimately, sustainability by controlling winter weeds and potentially herbicide-resistant weeds.

Double seeding on the headlands reduced the sorghum yield by 75%. The area on the far right yielded 2.0 t/ha.

Profitability of our no-till farming systems

No-till has increased our grain yields, profitability and water use efficiency. The system is robust under normal seasonal conditions and average prices. Overall, farm profitability since 1983 has mirrored the growing season's rainfall.

Since 1985, the four lowest average paddock gross margins were in paddocks that had a chemical fallow year during one of the first four years of that period. The loss of income during that one fallow year was not made up in the following years. Contrary to popular belief, the fallow year did not increase the overall profitability in those paddocks at any time over the following twelve years.

Wheat was not as profitable as canola or chickpeas but was less variable. In the 1994 drought, wheat was the only crop that covered the cost of production. Faba beans made a loss on low rainfall years. However, there could have been a beneficial yield effect in later years, due to elimination of diseases such as root diseases in cereals.

The conventional farming system with tillage and stubble burning, as practised by Cloverlea Farms before 1982, was unsustainable. It was unprofitable and damaging to the environment. In contrast, the no-till farming system with stubble retention and continuous cropping is clearly more sustainable.

Over the past 150 years, Victorian farmers have become accustomed to the loss of topsoil during dust storms and heavy rainfall events following tillage and stubble burning. This soil loss is accepted as normal. It is not normal. Soil loss does not need to be part of Australian agriculture. Farmers have also become accustomed to losses to salinity caused by rising water tables. This lost production is not necessary if rainfall is used where it falls.

The no-till farming system we now use, with continuous cropping using zero tillage and stubble retention, is much closer to the original vegetation of summer and winter grasses and broad-leafs that characterised the Wimmera plains before white settlement. This system also provides an annual income for the farmer and his local community as well as an export income for the nation.

No-till provides natural habitat for wildlife. At the same time, the complete replacement of nutrients through retained stubble and fertilisers ensures continuous food supply for both plants and the microorganisms that feed on them.

The technology is there to improve productivity through conservation farming. Cloverlea Farms changed reliance from wheat and livestock production to a variety of grains to improve financial viability, but not all farmers have that option. Different options must be found to suit different environments. There are few options to increase prices in the present economic climate but productivity can be increased. It is essential to farm with sustainability in mind- both for profitability and for the environment.

In conclusion, sustainability of any dryland farming system can only be achieved when all parts of that system are in balance. However, nothing remains the same—climate and prices are always changing. Sustainability is highly dependent on the successful management of those changes. In reality, sustainability is a moving target. Thus, how well nutrients, water and climate are converted into dollars, without upsetting the financial and ecological balance will determine the sustainability of dryland farming.

Warm Season Crop Experience Last Summer

Mark Adams, Woogenellup (08) 9854 1051, fax 39

We have a property situated at South Stirling's and, in 1997, we had a very wet year—with 625 mm. As a result, there was severe waterlogging in canola and Franklin barley. In 1998, some of the same country was sown to lupins and some of the remainder was too wet to plant a winter crop on. I became very concerned about what I was going to do with this very wet country. As time went by, we lost most of the lupin crop due to waterlogging, and it just kept getting wetter.

Summer crops looked attractive, if only to reduce the soil moisture enough to enable a winter crop to be established in the following season. We looked into what grain types and varieties were suitable and found that there was very little information available. After consulting Wayne Smith, on his return from a WANTFA North American Study Tour, I agreed to have a go with several crops.

Crops sown

There was 120 ha of very wet, shallow duplex country (50–100 mm of sandy gravel over domed clay) where I decided to plant forage sorghum (Jumbo and Superdan). On the deeper country it grew up to 3 m high. It was lightly grazed by cattle. It was not heavily grazed as I felt the water usage would be higher with the greater biomass. Weed control was good with 2 L/ha of Atrazine applied pre-sowing and sown in the last week of October with soil temperature 17–19°C, depending on the day. We swathed the crop down at the end of March as it was far too high to do anything with. This enabled us to plant a winter crop this season.

Safflower was sown in the middle of October on 25 hectares of shallow sand (5–10 cm) over clay. Grain Sorghum (New Nugget) was planted on the 25th October on failed lupin country. Again, weed control was good with 2 L/ha of Atrazine IBS. Shirohie millet was sown on a drier 20 ha section of non-wetting country, consisting of 20–70 cm of sandy-gravel over clay. I didn't think the soil was suitable for sunflowers.

Sunflowers, varieties Hysun 25 and Sunbird 5, were trailed over a large area of different soil types. The majority was deeper country—sandy gravel to a depth of 200–500mm over clay which, on best advice, was the best of a bad soil type that sunflowers would grow on. Against all advice, I also grew them on shallow sand over grey Yate clay, and they did very well.

How did they grow?

The Shirohie Millet would probably be the best grazing option in any given summer—wet or dry. It was a very vigorous grower and would have been the first crop to be grazed if anyone was looking for that option. The crop was not grazed and grew to 1 m high. It was swathed mid-March and harvested for seed 2 weeks later. It was very easy to grow, competed against all weeds well and had the least residue problems before establishing the next winter crop. Insects weren't a problem at any stage. It grew well on all soils.

Safflower looked more like a weed once established. It could be sown early as it didn't need warmer soil to germinate. It seemed drought tolerant at all stages of growth, and matured earlier than the other summer crops, making it earlier and easier to harvest. Crop residues were no problem. Some of the disadvantages of the crop are that it does not compete with weeds and it doesn't grow very high. It is also very prickly! In the presence of green summer weeds, harvesting can be difficult. Red-legged earth mite and wireworm needed to be controlled. There is a smaller demand for safflower than for some of the other crops.

Forage sorghum grew very well and probably had the highest water requirements. Weed control was made easy, as it is triazine tolerant. It could have carried a high stocking rate if grazing was an option. The downside was that, with only light grazing, it grew very high very quickly and the residue was difficult to handle. To get good establishment, soil temperature had to be 18°C before planting. Insects were of no concern in this crop, and spraying wasn't necessary.

New Nugget grain sorghum can be easily marketed in bulk as feed, with no cleaning required. It is also easy to harvest. Grain moisture can be a problem but it is quick and easy to dry. Like forage sorghum, weed control was easy with triazines and insects were not a problem, although budworm can occur during seed development. Crop residues were no problem for the following winter crop establishment. The soil temperature had to be right at sowing and the crop grew poorly near laterite stone. It didn't look as drought tolerant as other crops that you could plant earlier, such as sunflower, safflower and millet.

With the sunflowers, we chose two short season varieties. Good weed and insect control is important due to the low plant density required. We had to spray for red mite, wireworm, cutworm and wingless grasshoppers during establishment. End of season insect control—which we didn't do, due to lack of knowledge—should have been for Rutherglen Bug (which can cause huge yield losses) and budworm. The sunflowers did poorly on heavy ironstone country. All other soil types seemed okay. Yields ranged from 2 t/ha on the deeper soil types, down to 0.2 t/ha. Harvesting was easy —but sunflower trays were a must, even with a draper front, as head and seed losses would have been excessive without them.

Both Hysun 25 (black seeded) and Sunbird 5 (grey seeded) were harvested at 6–8% moisture. With the WA market being mainly for birdseed, all the grain had to be cleaned over a gravity table, making meeting the quality standards expensive. Also, some buyers only wanted the seed in 30 kg bags—an added expense! All that aside, sunflowers appear to have a place. They can be sown earlier, in cooler soil than sorghum, which is a big advantage. There is a larger domestic market for sunflowers than for safflower and millet.

Seeding

Summer crops were established with Walker double discs with coulters, at row spacings of 600 mm, which seemed okay. However, this year we will use 1.3 m wide spacings as it is not as wet as last year. We may also try some inter-row weed tillage on wide rows. Sowing depth of all crops was 3-5 cm. Getting seed well down into the moisture is important as you are dealing with drying topsoil at this time of the year. Fertiliser used was Agflow Cu Zn & Moly at 50 kg/ha placed with the seed. Fertiliser application is another area we can possibly improve on. More information is needed on responses to N, P, K and trace elements for all types of summer crops.

1999 Harvest Results—Profit and No Loss!

Grain sorghum yielded 2.0 t/ha at an on-farm bulk price of $160/t, less input costs of $52/ha. Profit was $270/ha. The advantages of this crop are that you don't have to mess around getting it cleaned or bagged, and dealing with small grain brokers. Remember, however, that it can't be planted for 3–5 weeks after sunflower, millet and safflower, making it possibly more risky due to summer drought.

Safflower yielded 0.5 t/ha at $640/t on farm, less input costs of $69/ha. Profit was $250/ha. It looked very drought tolerant, was the first summer crop harvested and didn't need drying.

Shirohie millet yielded 0.7 t/ha of grain at $410/t on farm, less input costs of $56/ha. Profit was $230/ha. It is easy to grow and not fussy about soil type. It had to be swathed to enable harvesting. There is only a small grain market, but grown for fodder, it would probably provide the best early feed with little management involved.

Sunbird 5 (grey sunflower) yielded 0.45 t/ha at about $450/t on farm (including processing costs and seconds value), less input costs of $68/ha. Profit was $135/ha.

Hysun 25 (black sunflower) yielded 0.5t/ha at $404/t on farm (including processing costs and seconds value), less input costs of $60/ha. The profit was $142/ha. These profits could possibly be doubled as our management of this crop improves. This includes spraying for insects at critical times—such as for Rutherglen Bug—better soil type selection, and appropriate fertilisers and weed control. With a greater understanding of what sunflowers require, they should perform as well, if not better than the other crops.

What now for 1999/2000?

We will be growing all of the above crops again, as well as trying Maize and French White Millet. Thank you for giving me the opportunity to relate my experiences and thoughts on summer crop growing to you all. As growers of these crops in WA, we still have a lot to learn, but there are many advantages to giving it a go. All the best! ■

No Tilling with Limestone

Alistair Ifould, Coomandook, SA (08) 8572 3715

The family farm is about 15 km SW of Coomandook in South Australia. I farm with my father (Peter), brother (Simon) and workman (Jason). Rainfall ranges from 400–450 mm from the northern to the southern part of the farm. Our soil types vary from sand to sandy loam over clay and we have some red flats with some limestone and limestone outcrops.

We crop 60%, have 10% in permanent pasture, while 20% is pasture that is suitable for cropping and 10% is scrub and shelter-belts.

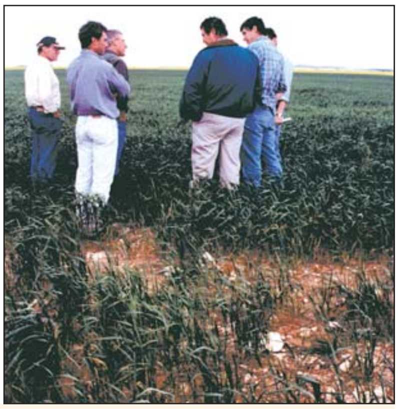
We have been no-tilling lupins for 15 years and now wheat, barley and canola for three years. We adopted no-till to reduce wind erosion on our lighter soils, improve our sowing window, increase our speed of sowing with the same amount of machinery and labour, and to reduce tractor hours.

We do not have any typical rotation as soil type varies too much. The balance of crops we grow are roughly 45% wheat (Frame), 25% canola (TTs), 15% lupins (Merit) and 15% barley (Schooner). Some rotations we use are:

1. wheat/lupins/wheat/lupins (our favourite—we would like to use it across the board)
2. barley/lupins or canola/wheat (good because of diversity)
3. wheat/lupins/wheat/canola (good if soil types allow), and
4. we can now sow canola on lighter soils due to lower risk of wind erosion with no-till.

We seed with a 61 foot Flexi-coil bar on 9 inch spacings with press wheels and a Flexi-coil air tank towed behind. We are set up for double shooting with Primary Sales Super Seeder points with Primary Sales double shoot boots. We have tried spring and radiator hose type seed boots but all have failed in stony conditions. Now we use solid type—which are actually meant for clean ground, but seem to be successful.

Another disadvantage with flexible boots is they tend to spray seed everywhere except in the furrow in stony conditions when the tine is working. Machine has been on 350 pound break-out, but we have had problems with breakages of



Limestone ridges make even seed placement difficult.

points when returning to the ground after breaking out on stony ground. We will set the machine up on 200 pound break-out this year. We feel we will get away with this because of our low draft soils plus our soil is now more friable due to several years of no-till.

Typical Spray/Sow Program

Cereal (Wheat)

1. Glyphosate at 1 L/ha plus goal if geranium is present.
2. Trifluralin at 1.5–2.0 L/ha plus SpraySeed if necessary—for late germinating weeds.
3. Sow wheat at 90 kg/ha plus fertiliser 26:11:1.6:1.2 @ 154kg/ha (supplies 40N, 17P, 2.5S, 2Zn).
4. Spray with Diuron/MCPA tank mix at 3–4 leaf stage for broad leaf weeds like radish, turnip, capeweed, volunteer legumes.
5. Spray with late 2,4-D Amine at 1.5 L/ha after tillering to clean up radish plus hold skeleton weed. (This is due to trying to avoid SU's.)

Canola

1. Glyphosate at 1 L/ha plus goal if necessary plus 1.6 L/ha of Simazine.
2. Sow canola at 4.5 kg/ha plus fertiliser 28:9:6:0.26 at 186 kg/ha (supplies 52N, 16P, 11S, 0.5Cu).
3. Spray as soon as possible after sowing with a further 600 mL/ha of Simazine plus insecticide (75 mL/ha of Dominex). We split the Simazine application because the sowing system grades the Simazine out of the trench and any weeds like silver grass or turnip come up in the trench. The top-up spray handles these. The Dominex is for red-legged earth mite.
4. Come back with 1.25 L/ha Atrazine to control radish plus grass herbicide if necessary (usually to control voluntary cereal).

We still run sheep and cattle because we have country unsuitable for cropping so we may as well be making something from that land. Sheep are also kept on the stubbles to keep down summer weeds– as we are sick of spending money on summer weed sprays.

Lucerne pastures are also established by no-tilling lucerne seed into stubble with a modified Chamberlain/John Deere 753 combine with press wheels. This March we will harvest lucerne seed from a paddock that was locked up in November.

Advantages of no-till

No-till leaves the soil stable with less wind erosion. It allows a build up of organic matter. We can sow at an optimum time with more acres but with the same machinery, same labour and with less tractor hours. No-till makes it easier to handle stubble. Because we leave it anchored, we now leave stubble higher at harvest (more on stalk, less on ground, more dirt for herbicides to hit). No-till also conserves moisture.

Disadvantages of no-till

There is more disease—is it only rhizoctonia? The soil can be left rough and the sheep and truck tracks don't get filled in. We might be using more herbicides but not a lot because we have come from minimum to no-till. The quality of our high N fertiliser blend is very hydroscopic. We are looking into a gas heater to fit to the air intake on airseeder from WA.

We spend a lot of time filling the air tank due to the high rates of fertiliser but this is outweighed by the one pass system. This is turn could be improved by fitting a larger auger onto the air tank for filling, plus a larger tank.

By leaving stubble we create a good environment for snails. The occasional burn may be required, which we can get away with because the no-till leaves soil rough and cloddy enough to combat the wind erosion.

Snails cause significant damage and sadly the cheapest and most successful way to manage these is the occasional burn.

Despite the disadvantages, no-till is our preferred method of seeding.

Expensive seeders aren't the answer!

Neil Wandel, Speddingup, (08) 9075 3031, fax 51

At the 1999 WANTFA Annual Conference I was asked to talk on my experiences with no-till.

Background

I moved to Esperance full of enthusiasm and youth in 1979 after leaving the family farm in South Australia. I started farming here with crops and sheep on a year-in year-out rotation, using conventional tillage. In 1981 I decided to continuous crop one-third of the farm, using pulse crops every third year. In 1991 I purchased my first no-till bar, a Janke, which created lots of interest in the district. Since that time I have been able to purchase more farming land and I am now cropping 95% of it continuously with no-till.

In the past eight years I have seen numerous farmers buy $150,000 no-till bars and move into 100% no-till and get extremely disappointed with their results. I consider the change to no-till is not just the answer to higher farm profits. No-till is only one very important part of a total farm cropping program. Considerations such as rotation, nutrients, weed control, cost inputs and end product pricing must be taken into account along with no-till to enable farmers to make a reasonable profit.

Sprays

Originally we were using Logran® heavily in our program and after 3–4 years I was wondering why my legume crops were becoming very uneven and not performing as well as previously. I did some test strips and

Neil inspects canola in full flower

left Logran® out in some areas of the cereal rotation. The next year the difference in the legume crops without Logran the year before was outstanding. Today I avoid using any SUs other than 2 g/ha Ally® to control legumes in cereal crops. It is interesting to note that I have five separate farms with different histories and the only farms I have ryegrass resistance problems on are the two farms with a long SU history.

Rhizoctonia

I do not worry about rhizoctonia. If I think I will have a problem I might increase our inputs, otherwise I have found that initially it gets worse then, once we get 5–6 years into a continuous crop rotation, it improves rapidly. I believe working the land to get rid of rhizo just spreads it to other parts of the paddock so that it is less noticeable but that in the long run it will be retained for a longer time *(Editor: This is the same result as David Roget's CSIRO work in SA)*.

Equipment and use

I still run a Janke seeder bar with a parallelogram system, with a coulter to cut stubble and a tine to place the seed. However, because of high maintenance, I am going to change back to fixed tines for all our bars this year. I feel we have now got control of our wireweed and melon problem, and I harvest all our cereals at a maximum height of 9" off the ground, and chop and spread the straw as I go. Last year, our heaviest crops yielded 5 t/ha, and I had no problems seeding into those stubbles with 9" spacings on my conventional bar—although there is a big difference between makes of seeder bars in their stubble handling ability.

Stubble burning

In my own district there is a big swing back to burning stubbles, mainly so that trifluralin can work better. *(Editor: Perhaps the rebirth of trifluralin granules will solve this problem)*. I believe burning is 'short-term gain for long-term pain' because I think we should be retaining as much organic material as possible for our soil. I get excited when I walk into a paddock and find the top inch of soil is worm castings and the top four inches of the soil is friable. Worms do love something to eat!

The future

I have had a very interesting 20 years working towards less-tillage and I have made a lot of mistakes and learnt much from them. I have seen vast improvements in our soil and I have seen general increases in yields. I look forward to see how my boys are farming in 20 years but I bet they will still be no-tilling. I feel comfortable in the knowledge that the soil has been maintained to the best of my ability. ■

Neil inspects his lentil crop