Newsletter of
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Western Australian No-Tillage Farmers Association (Inc)

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July 1999 | *"Sustainable high production agriculture – now!"* | Vol 7 No. 3 pp 257–276

No-till dramatically reduced water erosion up north

For those who had eyes to see, it was clearer than mud that no-till held the soils together up north during the recent floods. Read more in the Topical Section on page 262.

Kevin Bligh and myself drove through the flooded regions and observed how well no-till held the soil together. Peter McCrackan chartered a plane in late May to fly over the area and observed similar results. Read Peter's vivid description of the effects of tillage and earthworks on soil loss in his region.

From Northampton to New Norcia, conventional tillage has caused lots of soil water erosion and the lost nutrients end up in rivers.

Come to a WANTFA Seminar to learn how to grow this crop even better in 1999!

The Kirkwood's first attempt at sorghum on a failed waterlogged faba bean crop has been quite successful - this soil now has a good chance of growing a non-waterlogged winter crop in 1999.

WANTFA Coming Events

23rd July	Warm Season Cropping Seminar	Katanning
26th July	Warm Season Cropping Seminar	Moora
3–6th Aug	Central and Northern Field Days	York–Mullewa
16th Aug	Claying Seminar	Esperance
19th Aug	Claying Seminar	Wellstead
17–20 Aug	Southern Field Days	Esperance–Wellstead
23rd Aug	Claying Seminar	Badgingarra
30th Aug	Herbicide Resistance Seminar	Muresk

See inside for more details.

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

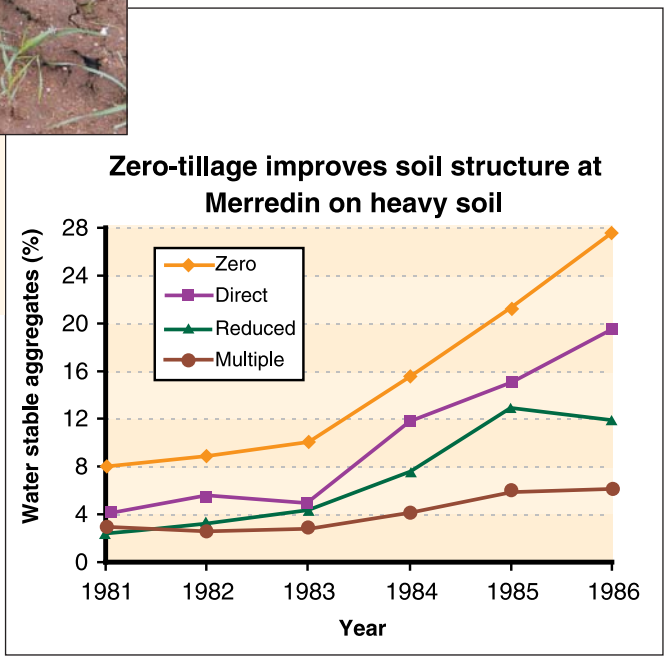
Ask the contractor what he thinks of your soil

I often hear farmers say "the spraying or spreading contractor can almost tell me how many years I've been no-tilling by how soft or spongy the ground is". And when you read the experiences of long-term no-tillers, they say the same thing—especially when they have been retaining straw.

Tony White's boot would have had 5 cm of mud stuck to it in these wet conditions at crop emergence, before he started no-tilling this paddock, four years earlier.

Read the farmer stories inside by the Cronin's at West River, and Allen Postlethwaite in Victoria.

Nearly 20 years ago, a long-term Agricultural Department project began which compared changes in the soil aggregates with tillage intensity. David Jasper started the research, which was later taken over by Ron Jarvis. It was on a heavy soil at Merredin. They confirm what older no-tillers have observed on heavier soil types—the soils get softer with least tillage and this has long-term impacts on crop yields. See 'Tillage history is important' later in this section for more.



Up goes the nutrients!

This April, as I was falling asleep, with my window open, I could often smell burnt stubble. There was a lot of burning happening, and yet a world-renowned no-tiller, Carlos Crovetto from Chile, says 'stubble is for the soil what grain is for man'. Burning the energy that this stubble contains means that the energy is not being put into 'life in the soil'.

The increasing amount of wheat being planted, combined with less pastures, frosted crops, a desire to burn weed seeds, and the lack of seeders that can reliably handle high yielding no-tilled crops has encouraged many of you to burn. Many farmers on the south coast have adopted disc seeders to improve residue management and limit the stimulation of weeds.

Burnt stubble is lost biological activity.

Above: Strategic burning is still losing nutrients and the burn needs to be hot to be sure the weed seeds die. This is where the Chaff-Top would be useful (see previous newsletter).

Right: This photo of dying ryegrass was taken the year after the AGWEST's 1992 zero-till trials on Ric Swarbrick's farm at Gairdner. Wherever the stubble was raked, burnt or cultivated there was more ryegrass. Strips going out to the right were deep ripped or cultivated.

The undisturbed zero-tilled area, with the Great Plains (on the left), had very few ryegrass plants germinate.

While it is true that cutting low, chopping and spreading evenly will help with residue management, this is not a foolproof approach to no stubble trouble. Even spreading the tines out, which usually does a reasonable job, did not beat the frost effect. Wide rows were still not a guarantee of no problems. There is an urgent need for someone to invent a reliable residue manager!

Glyphosate didn't kill all the weeds in April

This was a common experience this year, as it was for many in 1996. You may be wondering why the glyphosate did not work so well. Work by AGWEST researcher David Minkey gives some clear guidelines on the issue.

David developed an excellent Herbirate model. The model shows that increasing the mean day temperature alone by 4°C meant that twice the herbicide rate was needed for equivalent control. See the following table.

Ryegrass Development (# of leaves)	Soil moisture status (visual)	Mean degree days (°C)	Days since 5 mm of rain	Kill dose (mL/ha)
0-3	Excellent	12	1	293
0-3	Excellent	16	1	697
4-8	Excellent	16	7	799
4-8	Moderate	18	14	1555
4-8	Poor	18	21	2197
9-14	Excellent	16	1	908

David also demonstrated that N or P deficiency greatly reduced the efficacy of knockdown herbicides. For those of you who have had two non-legume crops in a row (like canola then wheat) the soil could be quite low in nitrogen, which may have restricted herbicide efficacy.

Note these 'alive' weeds at Kellerberrin, 2 weeks after being sprayed with glyphosate, when the weeds were only 10 days old. It was probably warm when they were sprayed in early April.

Discussions with Graham Laslett from Jerramungup suggest that adding oils and wetters greatly improved the efficacy of glyphosate in 1999. Spraying in the early cool hours has also been beneficial.

Beware of diuron post with no-till

Diuron can be a very effective addition to trifluralin before sowing. Its good water solubility allows some diuron movement into the furrow, which can give significant weed control in the furrows. On very sandy soils there is significant risk of diuron movement.

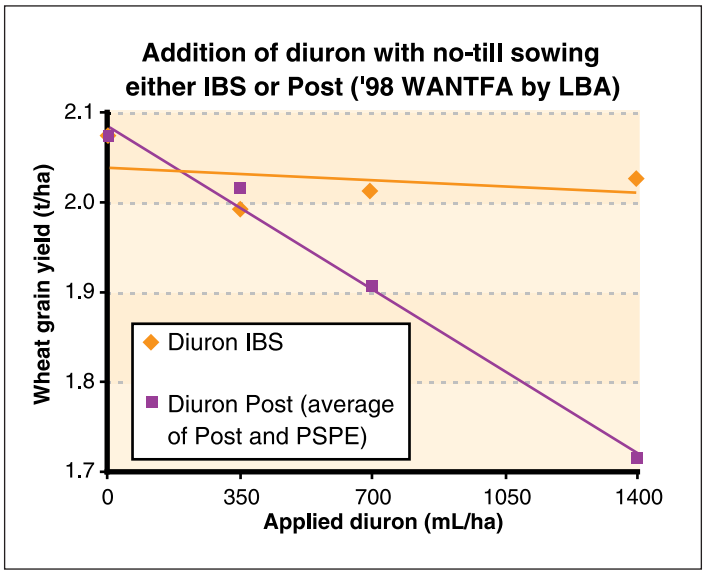
However, the high solubility of diuron (and triazines) makes it a dangerous product to use post-sowing with no-till where furrows are created. This is especially true if the soil is water repellent and press wheels are used. Putting the herbicides on 'up-front' or 'immediately before seeding' (IBS) is much safer than afterwards (see graph). Levelling the soil with harrows after seeding will stir up more weeds but might be needed if diuron has to be used.

The following graph shows how dangerous diuron can be when used post-sowing with no-till and press wheels without harrows. The site had few weeds and was sown on 14th June to Stilleto wheat at Cunderdin on grey sand over gravel.

The trial was conducted by Lamond Burgess and Associates with GRDC funds for WANTFA.

Tillage history is important

AGWEST researcher Mike Collins investigated the effects of the long-term soil improvements from no-tillage (as shown

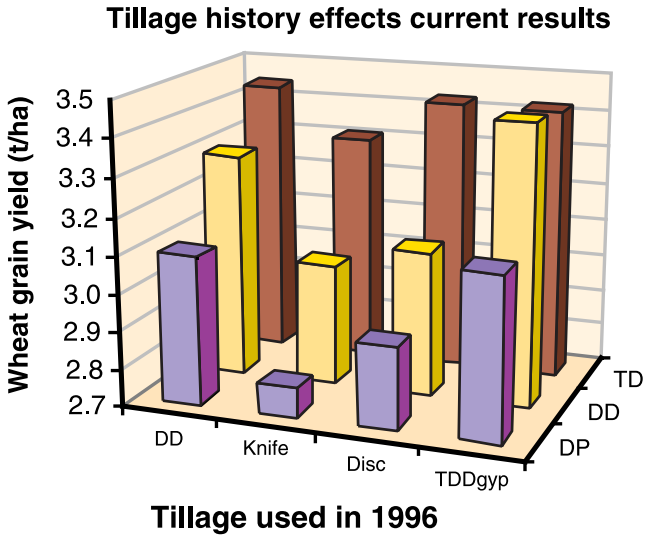


on the front page) in a trial in 1996 at Merredin. While there is an initial slight yield penalty for a farmer adopting knife points or discs on old cultivated soil, much of this penalty can be overcome with gypsum or maintaining a no-tillage program.

Mike says the benefit of gypsum was long lasting, and there were yield differences between tillage histories in favour of the least soil disturbance. Of the 'History' background treatments, 'District Practice' was the poorest and the zero till triple disc drill was the best.

Mike Collins has confidence in the long-term soil benefits of no-tillage.

The direct drilling disturbs more soil and mineralises more nitrogen. This becomes less of a factor, however, in determining yield when soil structure is improved, allowing better root development of the crop. The addition of nitrogen to the no-tillage treatments could have improved their grain yield. This data set also does not explore the timeliness of seeding opportunities over whole paddocks that structural improvements with no-till provide. ■



"No-Till Special" fertiliser users

It would be great if those people who purchased the 4,000 tones of the high analysis no-till fertiliser from CSBP and Summit could do some tissue tests. No one in WA knows if these new fertilisers for no-till are the sure way to go.

These products have high P, modest N and S levels, and are high in copper and zinc (1%). We need to know if these products improve trace element uptake with no-till. I have one trial at Newdegate Research Station investigating this aspect.

Hopefully, if you have used these no-till fertilisers, you have split paddocks to compare it with a standard fertiliser. Please take some tissue tests of with and without at 3–4 leaf stage, to see if they are working. I'd love to see the results. ■

Nematode warning!

Throughout the state, root lesion nematode has been detected, and it seems to be worse with no-tillage. Good advice would be to look for symptoms of nematodes when cereals are at the 3–4 leaf stage or early tillering, particularly in wheat after canola.

In paddocks where nematodes are suspected or known, it would be sensible to spray some test strips of Zn and Mn at early tillering. These early warning test strips will help decide on further trace element requirements. ■

President's Report

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

Are weather patterns changing or is history repeating itself? As farmers are still assessing the full extent of damage caused by very heavy rain and flooding at the end of May, this question is very real. The Esperance floods in January but very little rainfall since have been combined with extremely mixed fortunes, both statewide and for other states, for rainfall and seeding programmes. The issue of 'sustainability' of our system keeps on popping up, particularly with such extremes of weather—be they either wet or dry. Loss of any soil, stubble retention, rotations, early seeding opportunities, profitability and many other factors in the sustainability equation will need to be continually evaluated. No-till crop establishment appears to have stood up to the flood test well compared to other systems. My sympathies go out to those farmers dealing with these extremes, where unexpected costs are thrust onto you in so many different ways.

Weed management

How well have we used knockdowns in our seeding programmes? Over the next few weeks this will become much clearer to all of us as we carefully assess early crop growth, weed species and size. In recent years I have raised my knockdown rates considerably and the double-knock is now standard practise. I would urge you all to consider this very seriously, if you are not already doing so. The main reason is to preserve glyphosate as a 'key' weapon and to keep as much pressure as possible off other herbicides.

Jonny Gressell will be back in WA on 30th of August. Jonny is a highly respected person and President of the Worlds Weeds Society. We are organising a seminar to allow as many people as possible to hear Jonny's very challenging theories to our weed resistance problem. WANTFA has a real responsibility to our members to expose new angles on resistance strategies. Watch for more detail of an afternoon Seminar on weeds and resistance to be held at Muresk on Monday 30th August.

Other dates for your diary

- Seminars are planned for late July– on Warm Season Crops–at both Katanning and Miling. See the insert in this issue.
- August Crop Walks/No-Till days, run as separate events for north and south of the state, will be held over a number of days. Details are in this issue (see *August Field Days* over the page).
- Watch for a WANTFA presence at Dowerin and other Field Days, as much as our resources will permit.
- Dwayne Beck has plans to be in WA from Feb 28 to March 8 and may be speaking at our end of February Seminars and AGM.

WANTFA R&D

Excellent news received in early May, that GRDC funding has been approved for our WANTFA R&D Site. A lot of planning had been done to prepare for this possibility since the application in January. Some details of this project:

- We have five years of funding—other money is required and we are confident of corporate sponsorship.
- A sub-committee of WANTFA has been formed to manage the project, with Geoff Fosbery as Chairman. Committee members are David Bowran (AgWest), John Blake (Top Crop), Colin Pearse (Property owner), Ray Fulwood (Meenaar Group), and from WANTFA, Geoffrey Marshall, Owen Brownley, Paul Maisey and Bill Crabtree. Regular meetings will be held with a minimum of four per year.
- Agritech Crop Research (Peter Burgess) has been appointed as the Site Manager.
- The R&D site is located on Colin Pearse's property, 4 km west of Meckering, right on Great Eastern Highway. The 24 ha site is in three main sections straddling the Meckering Fault-Line. It will be leased for five years but the intention is to continue with provision for extension of the lease for a minimum of another five years.
- The Hart Site in SA and the Birchip Site in Victoria form role models for this one, except No-Till will be our main crop establishment system. Limited trial work is taking place this year with emphasis on setting up for a full trial programme in 2000.
- Rotations, liming , soil testing at three levels, fencing and planning processes have already received a lot of attention to ensure the very best outcomes are achieved.

This site has exciting potential for all farmers to relate to and I encourage you to follow any detail of trials and demonstrations and to have your say in research priorities for the R&D site.

The WANTFA Meckering R&D sub-committee. Standing (from left) are Owen Brownley, Paul Maisey, Geoffrey Marshall, Colin Pearse, Ray Fulwood and Peter Burgess. Front row (from left) are David Bowran, Geoff Fosbery and John Blake.

New admin

John Duff and his newly appointed Administration Officer, Mary Schick, have just commenced providing administration support for WANTFA. Mary is taking over Carolyn Middleton's role plus a more expanded part of everyday work. Welcome Mary—the committee is looking forward to working with you.

John will automatically have closer links with all that happens in WANTFA and we can expect only good things from this

DATES TO REMEMBER

August Field Days

Two circuits are planned – a Southern (higher rainfall) and a Central-Northern (drier). We will be covering some kilometres so bring a swag, and get into the serious evening discussions. The best trial sites will be visited so that you can learn from other farmers.

Central Northern circuit

Date: Tuesday 3rd August

Start: 9.00 am – Peter Boyle's (east of York)

Finish: 6.00 pm, Friday 6th August – Yuna Pub

Southern Circuit

Date: Tuesday 17th August

Start: 8.30 am – Alan & Matthew Jones' Neridup block

Finish: 6.00 pm, Friday 20th August – Jerramungup Roadhouse. For more details, see the last Newsletter.

Growing Warm Season Crops – Seminar dates

Times: Katanning Seminar – 9.30 am, Friday 23rd July at Katanning Recreational Centre

Miling Seminar – 9.30 am, Monday 26th July at Miling Town Hall

Cost: $20 members, $30 non-members

RSVP: by 20th July by fax to 9622 3395, pay at the door.

Warm Season Crop Seminar: Wayne Smith (left) is enthusiastic about the potential of warm season crops as he inspects Chris Kirkwood's (right) sunflowers in late 1998.

Lucerne thrived at Miling after the Moora floods—this lucerne has done very well despite the dry summer over 97/98.

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relationship. John and his Office will be providing a Perth contact for all members; something the committee has been working toward for some time now.

Carolyn is busy handing over to Mary as I write. Thank you Carolyn—you have been terrific for us all and we wish you well.

For your information

South Australia now has over 370 members of SANTFA and Derek Henderson has been appointed as a half-time employee for No-Till (equivalent to Bill's role).

There are two very informative inserts in your Newsletter. One is *No-Till Essentials—Top-Crop/WANTFA*. If you have this one, please pass a copy to a friend. The insert *Esperance Warm Season Crops after floods* is also well worth a look.

Your committee next meets on the 21st and 22nd of June in Perth at the Grain Pool. Input to the committee is very welcome prior to the meeting.

Until next time, good luck to all of you.

No-till has more to offer than banks

Peter McCrackan, Mullewa (08) 9961 9015, fax 05

After the recent heavy rains up north, seeding has ground to a halt. As I am a farmer and a Land Care Technician (Practical Farmcare Services), I took the opportunity to go for a catchment inspection on the 30th of May. I think all farmers should fly over their own properties once a year and take photos of their farms—it's very educational.

We chartered a flight from Geraldton and flew along the Greenough River until we got to a major tributary coming from Mullewa (Kockatea Gully). We flew along this drainage line to Mullewa and did some site specific fly overs, then made our way across to the Irwin River catchment and flew along the Irwin to Dongara. We missed the peak flows in these rivers by about 24 hours. The following observations are very general and are not site specific.

My first impression of the water within each river system was that it was very brown— it looked like a thick brew. As our flight progressed I was able to see why. All our soils were heading for the coast! We go to the coast every summer, but at least we come back—the soil won't!

Any paddocks cropped 'conventionally' were severely affected by water erosion. After this flight, I will not use the term 'conventional' when describing seeding techniques as it seems to legitimise an action that is not acceptable. I am now convinced that multiple tillage is not an acceptable way of planting a crop.

We flew over a lot of paddocks that had various types of earthworks, level banks and grade bank waterway systems. The most stable paddocks I saw were those simply no-tilled (stubble retained) on the contour, with no earthworks. Earthworks, on average, seemed to be almost irrelevant.

For these particularly heavy rainfall events, our thin WA soils will always fill up. That is, the rate of rain will exceed the rate of infiltration. Therefore we will have run-off. Under multiple tillage, or full-cut till, we need to have some sort of earthworks in place to reduce slope length, thereby reducing run-off velocities enough to prevent soil being carried off by the water.

These banks greatly reduced soil erosion—but the tillage in this system still encouraged soil loss.

The level bank systems were not very effective with these large water volumes as they had all overflowed and caused erosion. On the whole though, I think that, without these banks, there would have been an even worse mess under full tillage conditions. A distinct lack of maintenance on all types of banks and water disposal areas has created quite unnecessary problems.

The best way to beat soil erosion is to leave as much of our soils as possible undisturbed. After flying over catchments that I work in, I am convinced that 70% of paddock erosion can be stopped by no-tilling on the contour.

This no-tiller said he didn't know why he chisel ploughed this Irwin River flat to 25 cm (perhaps an old habit), but he knows that if he had only no-tilled it the 25–70 cm of topsoil would still be there and so too would his crop.

This direct drilled paddock nearly held together. Note where the seeder overlapped there was the erosion.

There is much reseeding to be done, when people get on their cultivated paddocks again. Many farmers had large areas washed away and poor germination and emergence caused by poor soil structure through over-working. I hope people can have a long hard look at the way our soils are managed? I hope we can all put in place systems that will minimise damage from rainfall events such as these.

In this, the last year of the first decade of Landcare, we still have muddy streaks heading off into the sea at every major river mouth. To be blunt, this is not good enough!

The millennium bug and farmers

Kevin Bligh, Committee member (08) 97557589, fax 90

The 'Millennium Bug' refers to the Year 2000 Computer Problem (also known as y2k). Early programmers saved extremely expensive computer memory by allowing only two digits for recording year dates. Therefore the year 2000 will be read as "00", and may be interpreted in some programs, and by some solid-state chips embedded in some machines and other devices, as the year 1900—with unintended results!

Kraft Cheese in the US, for example, found that their computerised automatic system had incinerated $3 million worth of cheese, because the computer interpreted its year 2000 use-by date as 1900! Problems have been considered real enough for Australian banks to spend $1 billion on y2k compatibility, the Australian Government $600 million, Telstra $560 million, and Qantas $147 million (or about half a year's profit).

Some emerging nations, including major buyers of agricultural commodities (even the world's second biggest economy, Japan) may not be as prepared, however. Many of the things that could go wrong may be trivial, such as wrong dates on video cassette recorders and microwaves ovens, but some may have larger consequences.

In major systems, things that may go wrong could have unforeseen effects, like Kraft's cheese! Investment house United Funds Management has said it will review effects of y2k in emerging economies before making large investments.

There may not be much farmers can do directly about y2k, except to keep a supply of materials for possible emergencies, and try to limit business exposure. Because effects of y2k are unpredictable and may be widespread, assistance may be late. And panic alone could cause a crisis! If everyone hoarded food just before New Year, for example, supermarkets would quickly empty, even if they are y2k compatible!

If y2k effects can be drastic, how did we get into this situation in the first place? Early programmers may have assumed their programs would be updated by now. In the US in 1968, 186 American professional associations petitioned then-President Nixon, unsuccessfully, to require four-digit dates. In 1970, genealogical research prompted four-digits in the Common Business Language. There would have been no problem!

Just then, however, a new IBM mainframe computer using two digits date fields became extremely popular. And a very large computer user, the US Defence Department, successfully argued that US standards should require only two-digits.

Embedded chips are a resulting wild card. While only a few percent may not be y2k compatible, each one must be checked. Then the systems that faulty ones are part of must be analysed, to assess effects of possible failure. Even then, some may be physically difficult to replace, such as in undersea oil drilling equipment or in nuclear reactors!

One can see how y2k may have happened. There may not always have been positive rewards for computer programmers worried about what may happen later, when even US Standards were against them. And doubtless, they liked to have a job—and eat!

If we farmers sometimes think that, as price-takers, we bear the brunt of things, spare a thought also for other small and medium-size businesses, who may not yet be comfortable that they are fully y2k compatible. Legal experts warn that companies or individuals that know the risk but do not ensure y2k compliance may be held liable.

A take-home message from ABC-TV's *Lateline* program on 28 April, was that no guarantees can be given. In a quaint touch, internationally-recognised y2k computer consultant Peter de Jager, when asked what he would be doing at midnight next 31 December, said he would be on a return flight from O'Hare Airport, Chicago to Heathrow Airport, London. But he also said that he would definitely not be flying into airports in some other parts of the world – such as Moscow, for example!

What everyone can do is work with and in our community. If we can't get an essential material, because the supplier's computerised system is experiencing delays, maybe a neighbour who has some would exchange it for something they may need of ours. Effects of y2k may even be a blessing, encouraging more neighbourly behaviour!

We might then also wonder whether looking after the parts of a system, and assuming the whole will look after itself, is a successful long-term way of living. Y2k may be seen as a wake-up call. If we don't hear it, there will no doubt be others, like fossil fuels becoming increasingly expensive because reserves are running out!

Systems theory proves that systems may, at times, behave quite unpredictably. Whole new ways of living can therefore emerge unexpectedly! We don't know what all the effects of y2k will be but we do know that some unforeseen things may happen next year as a result. It is only prudent to get essential things done this year, just in case. ■

Off the 'net...

The following no-till and stubble stories I have gleaned from the Internet recently (Mike Collins sent me one also—thanks Mike). I have greatly distilled them—my apologies to the authors!

No-till corn production in dry areas of Texas

James Smart and Joe Bradford

Because of the extreme climatic differences between their regions, farmers in southern Texas and northern Mexico have been reluctant to adopt no-tillage. With greater knowledge of the benefits and risks of no-till under a semi-arid, subtropical environment, producers can make better decisions regarding tillage practices.

Our three year study compared the effects of conventional, reduced and no tillage on corn yields and production costs during the transition to less tillage. Grain yields for no-till were lower than conventional by 9% and 20% of the first year. However, yields for no-till were 12% greater in years two and three.

Production costs were lower with no-till. A three year average of net returns for spring grown corn was $47/ha greater with no-till than reduced tillage and $104/ha more than conventional. The no-till systems were better due to greater yields in dry years and lower production costs in all years. ■

Water Use and Yield of Dryland Row Crops as Affected by Tillage

Charles A. Norwood

The dryland winter wheat-grain sorghum-fallow rotation is suitable for large areas of the US Great Plains. High temperatures and potential evapotranspiration limit the number of other crops that can be grown. Sunflower is drought tolerant, but crops such as corn and soybean are perceived to lack heat and drought tolerance for semi-arid areas.

I did a study near Garden City, Kansas, during 1991–95 and compared yields and water uses of conventional and no-tillage crops. I looked at corn, grain sorghum, sunflower, and soyabean to determine if crops other than grain sorghum are suitable for dryland production.

Corn and soyabean were similar in their depletion of soil water, as were sorghum and sunflower. Below a depth of 1.2 m, sorghum and sunflower removed the most water. Sunflower removed the most water from the last 0.3 m of the profile and probably removed deeper water. Sorghum and sunflower removed an average of 19 mm more water from the 1.8 m soils profile than did corn and soyabean.

No-till increased yields of corn in three year, of sorghum and sunflower in two year, and of soybean in one year. Corn had the greatest yield response to no-till, averaging 31% *(Editor: This recent scientific data validates the power of no-till and stubble retention with warm season crops in WA.)* Average yields of corn were 25% higher than sorghum yields, whereas average yields of sunflower were 83% higher than soybean yields. Other crops can be successfully grown in the wheat-row crop-fallow rotation but sorghum should occupy the most acres until the other crops have been tested under different climatic conditions *(Editor: This suggests to me also that sorghum is the first one to try.)* ■

No-till reduces water erosion

Kevin Bligh, Committee-member (08) 97557589, fax 90

Up to 160 mm of rain fell in two days in Western Australia's Northern and North Eastern Agricultural Areas in late May, demonstrating the water erosion benefits of no-till sowing. Country ripped up after earlier rain provided a comparison.

1998—and the Moore River takes valuable soil and nutrients out to the ocean.

Ten years of measurements which I carried out in Agriculture Western Australia showed that no-till sowing, using 50 mm-wide 'inverted T'-shaped points, reduced soil loss from water erosion by a factor of 35 as compared with work-up, work-back and sow.

The equivalent of only a little over 1 kg/ha of urea and superphosphate were lost in erosion under no-till, compared with 12 and 15 kg/ha under traditional tillage.

Calculations suggest that no-till sowing can reduce water erosion on sloping, loamy cropland in Western Australia to about estimated soil formation rates. Only no-till offers the possibility of keeping the topsoil in place for crop production indefinitely.

Both the no-till and tillage were between contour banks, on loamy-sand soil on about 5% slope. Surface run-off was about halved under no-till. Therefore, while bank spacings may be doubled under no-till sowing, occasional contour banks will still be necessary for sustainable cropping on sloping loamy soils—even with no-till sowing.

Intense rain can cause rilling of soil, seed and fertiliser, where the no-till sowing direction is up-and-down long slopes without contour banks. Sowing on an approximate contour is therefore worth considering, until contour banks can be built.

Working up-and-back rather than round-and-round may also have something to offer, particularly when working on an approximate contour. Wasteful double sowing with reduced yields on corner headlands is eliminated. Farmers now doing it usually do two or three rounds of the paddock first, before starting up-and-back across the slope.

Most farmers in the US and Canada routinely work up-and-back because they were used to mouldboard ploughs. In the days before remote hydraulics, Australian farmers went round-and-round—the only way you could go using one-way disc ploughs!

Contour no-till reduces soil and nutrient losses, even without contour banks. As a rule-of-thumb, any evidence of rill erosion could be taken as an indication that a contour bank should be surveyed immediately uphill of where the first rills start.

Farmers have shown that they have sustainability as well as profitability at heart, by adopting no-till sowing. Estimates suggest that up to 50% of Western Australian cropland may have been sown without tillage in 1999—up from 0.1% in 1990!

Western Australian farmers can ensure that loamy soils will remain in place indefinitely under cropping—for very little, if any, extra cost—by sowing on an approximate contour until occasional contour banks can be built. Think about it for next seeding, perhaps!

No-tilling pulses in diverse rotations means no worse diseases

B Gossen, G Lafond, K Bailey and D Derksen, Agriculture Canada.

(Editor: the following story was extracted and distilled from the ManDak home page of www.mandakzerotill.org)

No-till is being rapidly adopted by Canadian prairie farmers and is associated with increased surface plant residue. This residue is traditionally thought to increase foliar diseases of both pulses and cereals. Consequent changes in soil microflora and microenvironment may also affect the severity of root diseases.

In Saskatchewan between 1987–96, we examined three crop rotations and three tillage treatments; zero (with full stubble retention) reduced tillage, and conventional with regard to root and foliar diseases. Two of these rotations were primarily cereals and a third rotation included peas (pea, spring wheat, flax and winter wheat). *Fusarium* species were the main root rot pathogens and *Mycosphaerella* pinodes was the dominant foliar pathogen.

There were large differences in the severity of root rot and foliar diseases between years; root rots were more severe in dry years, while foliar diseases were more severe in wetter years. However, there was no consistent effect of tillage (and remaining residue) on the severity of root rot or foliar diseases during this study.

Economic analysis showed that the costs of production of peas were roughly the same for all three systems but yields under minimum or zero tillage were consistently higher, so the net return to growers was increased by reducing tillage.

A similar trial evaluated tillage and six highly diversified crop rotations on a range of agronomic factors. Lentil was included in all six rotations, with three years between lentil crops; pea was included in one rotation. Neither tillage nor rotation had a substantial impact on root rot (*Fusarium* species) or botrytis stem and pod rot (*Botrytis cinerea*) of lentil, or on diseases of pea. Including both pea and lentil in the same four year rotation did not affect disease severity. However, neither *Ascochyta fabae f.sp lentis* or *Colletotrichum truncatum*, which cause the most important foliar blights of lentil in Saskatchewan, occurred at this site.

Lentil and pea yields were similar across tillage and rotation systems, with zero-till yields generally slightly higher. Net returns were consistently higher under zero-till.

The risk of short rotations

This lack of response to tillage, however, won't necessarily apply to a shorter (three year) rotation. The amount of inoculum available to initiate a new epidemic was even higher in the year after lentil than it was in the initial crop. After one year out of lentil, the amount of inoculum available was still as high as when the trial started. It was the end of the second year out of lentil before inoculum levels declined substantially. The breakdown of lentil residue, and disease inoculum, is much faster when buried.

Because zero-till leaves more residue on the surface, there is likely to be more inoculum at the soil surface in the zero-till fields in the third year following lentil year than in conventional tillage. Therefore, the risk of a disease outbreak when rotations are shortened from lentil every four years to once every three years is higher under zero-tillage than conventional tillage. A field trial to assess this risk was established at Indian Head in 1995 and will continue until 1998.

We conclude that, for pea and lentil diseases in the black soil zone, tillage practice does not affect disease severity when there is at least three years between successive crops, but tillage may affect severity in shorter rotations.

No-till sorghum following corn or sorghum in Nebraska

R Klein and G Wicks, Nebraska University, USA

(Editor: I have heavily edited this old "Farmnote", but it makes for useful background information)

The ecofarming (chemical fallow) system using a winter wheat:ecofallow corn or sorghum:fallow rotation has increased corn and sorghum yields because more water is conserved by controlling weeds with herbicides than with tillage.

Often in Nebraska, enough rain is received from December–April that another crop of sorghum could be grown instead of fallowing and planting wheat. If 2 t/ha or more of cereal residue are present to protect the soil surface from wind and water erosion and to conserve moisture, another sorghum crop may be considered. When sorghum is no-tilled into either weed-free ecofallow corn or sorghum stubble containing wheat residue, the sorghum yields are often increased by 35% over conventional tillage.

Corn should not follow a corn or sorghum crop unless, by planting time, the moisture supply has recharged the soil profile to nearly 6 feet. Sorghum, being more drought tolerant than corn, is usually a better choice. Some farmers have extended the 4 year rotation to 5–6 years. Other reasons for extending the rotation are to break the cycle of weeds and wheat diseases.

Once no-tilling then moisture is the key!

Sorghum re-cropping is best suited for areas that have more than 18 inches annual rainfall, and have soils that can store a minimum of 1.25 inches of water per foot of depth. The chances of growing a successful no-till sorghum crop are reduced if less than 3 feet of soil are saturated at planting time. With less than 3 feet of moist soil, fallow the land and plant to winter wheat. Soils that have less water holding capacity need at least 4 feet of saturation.

Do not graze or harvest prior crop for silage

It is important that the sorghum/corn residues from the prior crop be maintained to protect the soil surface and the fragile winter wheat residue. Limited grazing can occur for a very short period of time. Grazing cattle will plant seed from the previous crop and weeds with their hooves.

If the prior corn or sorghum crop is harvested for silage, the fragile wheat residue will blow out of the field. You will then be trying to no-till without crop residues, which reduces weed control and moisture conservation. Crop failure is likely to occur.

Weed control

A number of pre-emergence herbicides can be used in continuous no-till sorghum. These include; Atrazine, Bladex, Dual, Bicep, Lasso, Igran and Bronco.

An excellent weed control program is to spray the sorghum stubble 4–6 weeks before seeding with Bladex + 2,4-D. The land should be fallowed and planted to winter wheat 3 months later if moisture is insufficient. If sorghum is planted, apply additional herbicides for controlling weeds. Generally, Atrazine should be included in the herbicide combination.

If summer annual weeds become a problem, shift out of the continuous rotation of sorghum and plant winter wheat so these weeds can be controlled. Shattercane can be a major problem in continuous sorghum.

Selecting the sorghum and soil temperature

Using the wrong hybrid can offset all the other right decisions. The biggest risk is selecting hybrids that are too extreme in maturity. Short-season hybrids lack yield potential, while long-season hybrids may yield poorly because of limited soil moisture and frost. A long-season hybrid is usually the most risky unless silage is an option. However, silage means you will lose the residue needed in the rotation to reduce wind and water erosion.

Because the length of the growing season varies, it is best to stay with mid-season hybrids. Sorghum should be planted at 40–50 thousand seeds per acre. Use the lower rate in regions. If soil temperatures are cold, increase the seeding rate by 10 percent.

Sorghum planting should begin when the soil temperature at 2 inches reaches 65°F. Soil temperature beneath residues will be a few degrees cooler than the bare soil.

Insects

Wireworms and greenbugs are the two main insect problems for sorghum. Wireworms can be reduced by seedbox treatments of insecticides at planting. If a large wireworm infestation is anticipated, increase the planting rate to compensate for some of the damage that will be done by this insect, or use a band application of a soil-applied insecticide *(Editor: this is a new one!)*.

Diseases

The primary disease of sorghum is stalk rot. If possible, plant tolerant hybrids. The incidence of stalk rot under the ecofallow system has not been as great as under conventional tillage. Sorghum growing in stubble is less stressed since soil temperatures are cooler and more soil moisture is available, thus reducing stalk rot incidences.

In a three year study, stalk rot was reduced 28% and grain yield increased when grain sorghum was grown under no-till ecofallow, as compared to conventional tillage. Minimum tillage was also included in the study, and stalk rot incidence was increased 12% compared to ecofallow. Other diseases usually are minor and have not seriously damaged the sorghum crop in this rotation.

Tillage, Herbicides and Weeds in Rotations

David Minkey, AGWEST, Merredin (08) 9081 3111

In a five year trial at Avondale, both tillage and herbicides treatments were compared for their effects on weed populations in a wheat:lupin and a wheat:pasture rotation. The work showed that rotation has the biggest effect on weed population, followed by herbicides and then tillage intensity.

Given that adequate weed control is achieved through rotations and herbicides, reducing tillage from direct drilling (full-cut) to no-till (knife point) seeding can reduce annual ryegrass and wild radish populations. However, an increase in medic population was found with no-till.

Background

Changes to cropping systems will affect the population, or spectrum, of weeds which can effect the future sustainability and profitability of agricultural land. Three such changes are currently happening in WA, these being a reduction in tillage, developing herbicide resistance, and more continuous cropping.

It is claimed that in no-till farming systems some weed species decline in numbers with reduced tillage. Overseas work suggests this decline is species-dependent and that the effect of herbicides and crop rotations may mask the effect of tillage. The implications of a change in weed burden or spectrum with reducing tillage are critical from the issue of crop rotation and weed management decision-making.

Our current WA knowledge about no-till effects on weeds is limited to farmer and agronomist observations, international literature, and a knowledge of weed ecology and herbicide technology. Predictions from this knowledge base have been used to formulate weed management strategies for no-tillage farming systems with varying degrees of success. This limited weed knowledge and the herbicide resistance issue makes an understanding of such interactions important.

The trial on Avondale Research Station was initiated by David Bowran. The design includes two rotations, two tillage treatments (no-till and direct drill), ten herbicide treatments applied in the cropping phase (see below) and three replicates. Herbicide treatments were completely randomised within blocks; tillage treatments were split within herbicide sub-blocks.

All cropped treatments received a knockdown herbicide and lupin blocks received 2.0 L/ha of Simazine. The pasture phase of the rotation received no herbicides.

LUPINS	WHEAT
1. Nil	Nil
2. Diuron 2.0L PPPE	Logran + Lontrel 35g + 0.1L IBS
3. Avadex 2.0L IBS	Diuron + Glean 1.0L + 1.0L IBS
4. Verdict + Eclipse 0.5L + 7g 3 leaf	Diuron + Stomp 1.0L + 1.0L IBS
5. Stomp 2.0L IBS	Diuron 2.0L PPPE
6. Simazine 1.25L PPPE	Diuron + Logran 1.0L + 30g PPPE
7. Select + Brodal 0.25L + 0.15L at 3 leaf	Diuron + Stomp 1.5L + 1.5L PPPE
8. Diuron 2.0L IBS	Hoegrass + Jaguar 1.5L + 0.5L 2nd tiller
9. Lexone + Select 133g + 0.18L at 3 leaf	Achieve + Eclipse 0.28kg + 7g 2nd tiller
10. Diuron + Frontier 1.0L + 1.0L PPPE	Logran + Puma 35g + 1.5L IBS + 2nd tiller

IBS = immediately before sowing and PPPE = post plant pre-emergent.

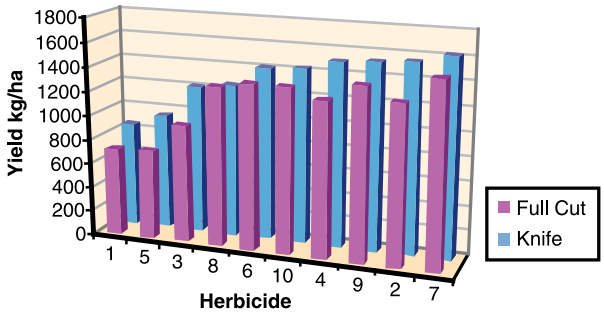
For 5 years the left hand plot has been direct drilled while the right hand plot has been no-tilled.

For 5 years the left hand plot has been no-tilled while the right hand plot has been direct drilled.

For 5 years the left hand plot has been no-tilled while the right hand plot has been direct drilled.

Grain Yield

Grain yield of lupins after 5 years of tillage and herbicide treatments varied from 700 kg/ha to 1600 kg/ha depending on treatment (see graph below). Herbicides had the biggest effect on yield followed by tillage. This appeared to be due directly to wild radish and annual ryegrass populations which are the most abundant weeds in the trial. The no-tillage plots tended to give higher yields. LSD at 5% is 298 for herbicides, 133 for tillage and 421 for herbicide by tillage.



Rotation

Rotation had the biggest effect on weed population, (in particular, wild radish and annual ryegrass) with the pasture:wheat rotation having far fewer weeds under all herbicide treatments than the lupin:wheat rotations.

Herbicides

Herbicides had the second biggest effect on weed populations and, in particular, selective herbicides applied in crop in the wheat/lupin rotations (see table below). The exception was Hoegrass®, which selected for resistance in the second and third years. The combination of Diuron PPPE in the lupin phase and Logran® and Lontrel® applied IBS in the Wheat phase also reduced the populations of wild radish and annual ryegrass to very low levels. Annual ryegrass and wild radish populations after wheat in the pasture/wheat rotation showed few trends to herbicides.

	Ryegrass		Radish		Medic	
Herb	Knife	Full cut	Knife	Full cut	Knife	Full cut
1	556	589	68	139	118	78
2	23	148	0	3	113	98
3	72	215	241	311	229	117
4	131	223	33	64	61	19
5	229	451	336	171	211	88
6	96	178	10	112	111	28
7	30	109	21	64	102	31
8	159	294	23	13	153	116
9	57	114	0	3	228	173
10	0	57	46	109	78	59

Tillage

Annual ryegrass and wild radish populations tended to be lower under a knife point than a full cut seeding practice. This was more marked as weed control improved with herbicides. Medic was the only weed species that tended to be higher under a knife point than a one pass full cut seeding practice, and this occurred only in the wheat/lupin rotation. All other weed species showed no trend to tillage, however these were relatively minor weeds and did not influence grain yield.

Discussion

Weed burden and, in particular, annual ryegrass and wild radish populations, severely reduced the yield of the lupin crop in the fifth year of this trial. Knife point treatments out-yielded the full cut treatments. This was probably due to weed burden but other factors such as improved soil structure should not be dismissed. The importance of controlling weeds was therefore intrinsic to high yields in this trial.

Rotation had the biggest effect on weed burden, followed by herbicide and then tillage. The effect of tillage was greatest when there was moderate to good control with herbicides, predominantly with selective herbicides, or rotation. However, with very low herbicide inputs, large numbers of weeds were still found under both tillage treatments indicating an interaction between the two. Therefore reduced tillage alone will not lower weed burden. So while we can conclude that reduced tillage can lead to a decline in annual ryegrass and wild radish populations, care must be taken to ensure that adequate weed control measures are in place to achieve this and that other potentially competitive weed species, such as medics, are controlled.

The mechanism(s) leading to reduced annual ryegrass and wild radish numbers under knife points are not fully understood. Possibilities include: the marginal moisture conditions found on the soil surface where most of the seeds in the no-till plots would be found; dormancy issues with light and mechanical breakdown of pods in the case of wild radish; improved efficacy of soil applied herbicides; or increased residue cover in the no-till plots inhibiting germination.

Similarly, the mechanisms behind an increased or maintained population under direct drilling are also not fully understood. Mechanisms may include self-burial, small seededness or the ability to germinate under marginal moisture conditions. Potential species that fall under this category and have been observed to invade no-tilled land include; marsh mallow, silver grass, clovers and medics, African lovegrass, statice and other perennial species.

Threatened with herbicide resistance and considering reduced tillage is a requirement for the prevention of soil erosion and improving soil structure, perhaps we should then view no-tillage as an integrated weed management tool. This being so, no-tillage seeding systems—coupled with alternative weed control methods such as crop rotations, seed catching and high seeding rates—could see a reduction in the reliance on herbicides and should be an area for future research.

Urea additives for reduced drilled urea toxicity for canola and wheat

Bill Crabtree, Scientific Officer 0417 2233 95 (GRDC funded)

Because many farmers see the benefits of not putting urea with the weeds, other more precise but safe methods need to be found. Many farmers band nitrogen below the seed, but this can lead to leaching in the furrow in some soils. Another option is to soften the impact of urea—our cheapest form of nitrogen currently available. Both plastic coating and Agrotain-treating urea will reduce seedling damage.

In seven trials conducted in WA with GRDC funding, I tested these products for crop damage and final grain yield. The trials were located at Dowerin (wheat), Narembeen (wheat), Hyden

(wheat and canola), Gairdner (wheat), Avondale (canola) and Ogilvie (canola). Urea drilled with the wheat gave, as suspected, severe crop damage on the sandy soils. Agrotain reduced the urea damage by half, with canola, and by a third with wheat. Plastic coated urea was very safe—in fact it took 400 kg/ha of plastic coated urea to give the same damage as 40 kg/ha of straight urea.

At three of the four wheat sites, Agrotain at 33% of the recommended rate in 1998 (1.7 L/t of urea) also improved crop safety. However, the full rate was always most beneficial and economical. On the basis of this work, I would suggest that if anyone were contemplating drilling urea with crop seed, then Agrotain would be very beneficial—especially for canola.

Unfortunately, the plastic coated urea was twice as thick as requested (5.2 vs 2.5% by weight). Despite this, it still gave excellent grain yield improvements with perhaps 33% of the urea not being released by mid-September. In two SA wheat sites, the addition of low rates of urea decreased yields (without crop damage), yet the plastic coated urea did not.

In the WA trials, nitrogen gave grain yield responses with up to 80 kg/ha of urea. From then on, the damage was too severe and plants were unable to compensate. Yield losses with Agrotain-treated urea usually occurred when more than 120 kg/ha of urea was drilled. Yield losses never occurred with the plastic coated urea. Protein improvements were similar for different urea additive treatments—despite grain yields lifting with the plastic coated urea.

A limitation of this research is that top-dressed urea was not compared. Four trials are being conducted in WA for the 1999 season with top-dressed urea included. Two trials will be with wheat and two with canola and they will be at Meckering, Avondale and Gairdner. WANTFA will keep you posted. ■

Left: Nitrogen toxicity is a real issue when N is placed with the seed on wide rows in sandy soils. Here 12 units of N at Wongan Hills really thinned the wheat crop on the right.

Left: This Hyden wheat crop (centre plot) was damaged by 200 kg/ha of urea, when drilled with the seed. Thanks to the sponsors of these trials, these being: GRDC, Planet Polymer, Fernz-Agrow, Whitford's Fertilisers, CSBP, Planfarm, IAMA and the farmers Parker's, Maisey's, Gibson's, Marshall's and Keding's.

Above: Wheat at Blyth (SA) sown with Agrotain treated urea (left) or with straight urea (right).

Left: Canola responds to 50 kg/ha of plastic coated urea (right plot) compared to no urea (left plot) at Avondale Research Station. This is despite some of the urea still not released when this photo was taken in September.

Below: Wheat emergence improved with plastic coated urea at 400 kg/ha (left) versus 200 kg/ha of urea drilled with wheat at Hyden in 1998.

Above: Evidence that the urea had not let go by September is in the urea granules—many are still intact.

Below: The plastic coated urea provided excellent crop safety—in fact it was too safe and not all released.

No-till farming at Chambejo Farms

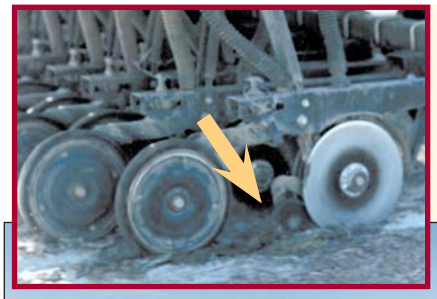
Harold Cronin, West River (08) 9835 7015, fax 12

In 1992, Barbara, Chris and myself decided our farming practices had to change at West River on the south coast. Erosion from wind and water were disheartening. This was made worse by hard setting soil with poor structure running through the centre of our farm. So we started looking for a machine for the task.

Tom Atterby had been to the NSW Orange Field Day and he had brought back a Great Plains seeder to trial in our area. After seeing the results of the seeding done, we decided it could be the way to go for us.

Harold and Chris Cronin are excited about the soil improvements from no-till and the options it creates.

We had the chance to purchase a 30 foot folding Great Plains seeder through the local dealer. With the help of Tom, we traded all our ploughs and other tillage machinery and hired the machine out for the first season to help pay for it. We had burnt all our bridges so it was all—or nothing!



The Great Plains discs with a seed press wheel (see arrow) which pushes the seed into undisturbed firm soil. Harold says this improves germination in dryish conditions by about 15%.

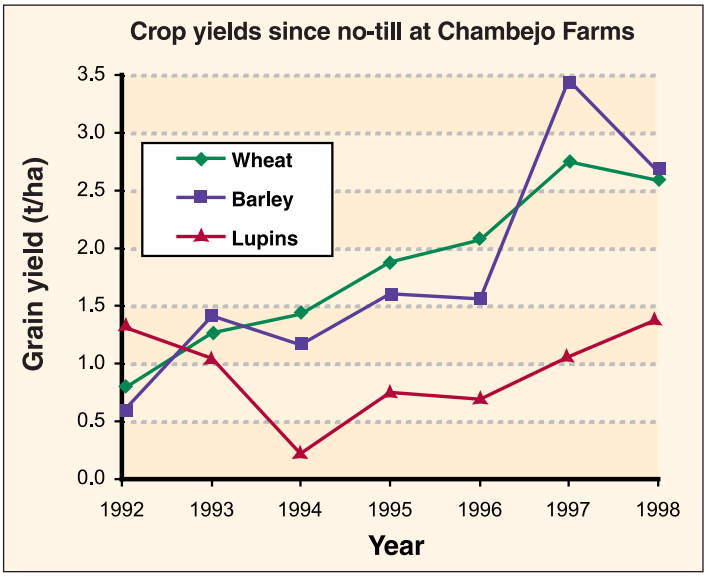
The Great Plains seeder leaves small furrows for water harvesting - but it doesn't fill in sheep tracks!

Disaster then success

The first year was a disaster—we did not have the chemical experience required for no-till. We had insects, including paddy aphids, and numerous weeds which gave us big problems. Fortunately, local AGWEST agronomist Graham Laslett gave us some sound advice, for which we thank him.

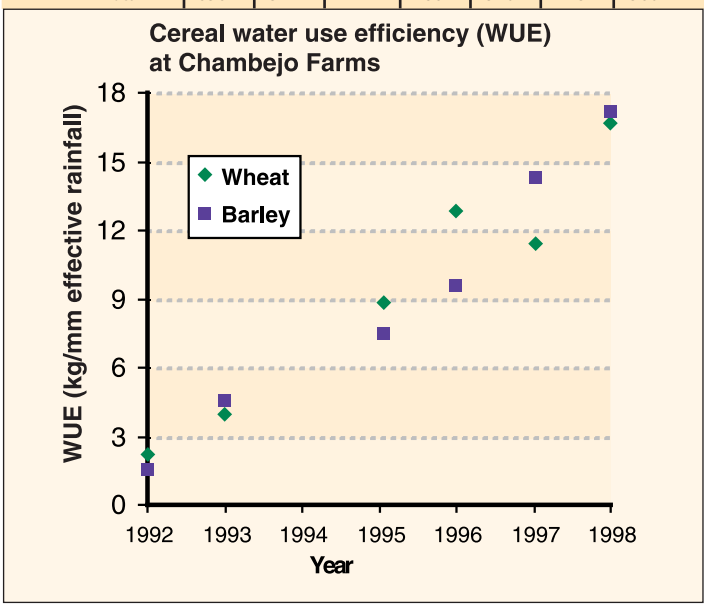
In early 1993, we employed David Rees as our farm adviser. David was also involved in the birth of no-till, while he was working for the Department in Jerramungup along with another no-till person Bill Crabtree. David helped us set about a program of sprays and fertilisers. That year the whole family, including Chris and his new bride Stacey, along with our daughters Joanne and Megan and Megan's husband Craig Chambers, helped to get the show on the road, and we had the result for which we had hoped.

That was the kick-start we needed. And each subsequent year, things just kept improving, as the data below shows. Our five year average before no-till was similar to the yields of 1993 for all three crops.



The hard setting soils we had given up on are now growing good crops. The improved yields are not due to better seasons as the table below shows. In the horror drought year of 1994 we were still able to grow reasonable cereal crops on virtually no rainfall. Perhaps the crops accessed some deep water. *(Editor: I did some calculations on Harold's water use efficiency of his crops through the seasons and, in 1994, the Cronin's achieved a ridiculously high value of 60 kg of wheat per mm of effective rainfall (effective rainfall being defined as [November to April]/3 + [May to October] - 110).*

Year		1992	1993	1994	1995	1996	1997	1998
Rainfall	May-Oct	425	347	117	284	217	291	221
	Total	656	544	141	486	320	475	360



In fact, the best yield we had ever had on our 'mongrel paddock', with conventional farming was 600 kg/ha of barley. Consequently, we didn't crop it for eight or more years, until Chris decided to seed it with the Great Plains to Skiff barley in 1996 and it then yielded 1.0 t/ha. In 1997 it was seeded to canola which yielded 0.8 t/ha and, in 1998, it was seeded to Franklin barley and Datatine wheat— both yielded over 2 t/ha. The soil structure has changed to be more friable and, with stubble retention and no sheep, the soil is not getting baked and packed like a brick. We are now getting quite excited about the possibilities of no-till on these soils.

The Cronin family are amazed at how well the mongrel paddock did in its second year of no-till.

With no-till we have found we have opened our window of cropping to a new level of opportunities. We have better moisture retention which enables better seeding timing, less machinery, less labour time per hectare, less fuel, less parts and repairs, as well as a lot less wind and water erosion.

Pros and cons of no-till

One concern with no-till is that your water supplies in your dams will be in trouble unless you have roaded catchments. We have had no water in most of our dams for the first time in 30 years and so have had to put in drains to feed the house dam.

The other problem we are having is sinking mobile field bins. If left overnight in paddocks, full bins are inclined to sink 5–8 cm. The ground itself is firm enough to drive over with a load on but it is very spongy and absorbent.

Since no-tilling we have seen big changes. Soil structure has greatly improved, our weeds are changing—our main weeds to consider now are clover and mallow but I feel that if we keep alert and experiment, new doors will open. The other interesting thing that happened is the amount of earthworms in the soil that we have not previously noticed. After a good rain it is possible to drive through the cropped ground without having slop for the first 5 inches and having firm soil under that, but when you sink—you sink!

Machines and methodologies

We have not had success with wavy coulters. We tried the wavy coulters on one machine and none on the other, it took a lot more horsepower to pull and with no resultant yield difference. All the wavy discs seem to do is hairpin in our soils. We find that when using just the one leading disc it cuts well and we switch the discs over when the leading one wears. The 'kiss point' in relation to the ground seems to be the most important aspect.

The seed press wheels improve germination by about 15% in a dry year, with very little moisture. Under wet conditions they are of no help. In dry conditions the seed press wheels widen the planting window. That window has enabled our workman (Jay Francis) to seed 1,851 ha in daylight hours only and finish the seeding by 18th May 1999. We have 130 ha of vetches to seed in the 'mongrel paddock' about mid-June.

Lupins do have their place in crop rotation system. This lets us use a different group of chemicals to counteract resistance and give benefits to the following year's crops.

And sheep… well, after spending 35 years of culling and getting them to where we wanted them, I don't think I should put in print what I think of the greed of the people between us and the consumer who have ruined an industry that got this country on its feet.

In the mode that we are in now I cannot see a place for sheep, unless wool gets up to 1200 cents greasy—I think we will have more chance winning Lotto!

The soil structure has more chance without sheep packing it down and baring it off and making tracks down hills to water and through gateways. I hate to admit it but, in our way of farming, the sheep must go.

Last year we tried swathing lupins and the results amazed us. I think we were wasting 25% of our crop in previous years. We also tried some sunflowers and other various crops on hard soils, sandy soil and rocky ground and were generally pleased and surprised by the results (see photo). The only other summer crop we tried was in 1973 and it was French Millet. It grew to around 2 m high but, seeing that it was only for cattle which we do not run now, we don't grow it.

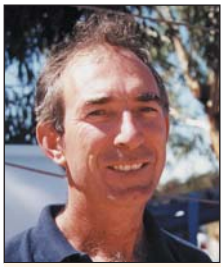
Harold's brother-in-law, Peter Denton, is fascinated by the sunflower

experiment.

You will see by the data that, in 1998, the wheat yield was 2.6 t/ha. This was after continuous rain all through harvest. The first paddock of wheat was yielding 5.5 t/ha and barley was over 6 t/ha—so much for a bumper year! The cereals grew very well in the head and went flat on the ground so we had fun, or should I say, Chris did. Farming, don't you love it? At least we finished the canola before the rain.

Towards less tillage at Wubin

Keith Carter, Wubin (08) 9664 3051, fax 20



Keith Carter

Our move into no-till has all been with legumes, mainly lupins. Our cereals are either direct drilled into legume stubbles or a one cultivation and sow method. The plant we use is basic and home-modified. An old 4-150 Shearer with Super Seeder points and a fifth row has been added, which opened us up to 10 inch row spacings.

We were wanting to keep all the stubble to assist with disease control. It worked okay, but the stubble was still a problem—especially when damp. Our problem was not cutting the straw short enough and then spreading it with a chopper, but we didn't realise the extent of this problem until we bought higher capacity headers.

To handle more straw we moved to 12 inch spacings, still using Super Seeder points and light chain harrows. The stubble handling was better, yields seemed better and pre-plant chemical rates could be raised. Although pre-plant spraying seems better, post-emergent grass control in a low rainfall year can be worse because there is no shading in the inter-row.

Another problem arose through too much fertiliser being placed with the seed, so a set of Primary Sales coil tines with deep banding boots were fitted to the same old bar. This gave much better penetration and more trash clearance, as the coil tines are much taller. To deep band we also changed to knife-points and this seems to be loosening the soil well and to have a deep tillage effect.

Speed at sowing has been dropped down to 8–9 km/hr. The chain harrows were left off this seeding after seeing too much herbicide damage last season done by chemicals being pulled back into the rip furrow.

I have sown faba beans and chickpeas on red York gum loams and had trouble with smearing with knife points. A change of points for red ground or press wheels may be needed. This isn't a problem on all red ground soil types. Press wheels are not fitted because they are not well proven in this area but this is changing with a better understanding of how light the pressure needs to be and with AGWEST's work with lupins.

I haven't tried cereals no-till because direct drill has been cheaper, not requiring as much knockdown. The yields have been all right. I suppose some tillage is healthy in the "if you are on a good thing, don't stick to it" message. I think a form of no-till sowing for cereals with deep tillage is going to give improved yields and we are trialling some machines this year with assistance from local dealers.

Fighting weeds with no-till in Victoria

Allen Postlethwaite, St.Arnaud Vic (03) 5495 3228, fax 53 or ypos@ruralnet.net.au

Cloverlea farms is 1,875 ha in size in 400 mm rainfall area in the Wimmera and we specialise in grain production only. The farm is 66% self-mulching grey clays with a pH of 8.5. The rest is hard setting red duplex soils with a pH of 6.0. All our soils are sodic. The growing season rainfall averages 270 mm falling between April and October.

Crops grown include: cereals—wheat and barley; oilseeds—canola, safflower, and linola; pulses—chick peas, lupins, lentils, and faba beans and a summer crop—grain sorghum. All crops are no-tilled with 12 mm wide points, into stubbles left standing after harvest. Cereals and oilseeds are usually sown on 355 mm row spacings while pulses are mostly sown on 710 mm rows.

The Postlethwaites have a growing confidence in the role of warm season crops—even in their 375 mm rainfall country.

Allen Postlethwaite's no-tilled canola into pasture.

To win the battle against weeds it is essential that no-tillers develop systems that use all techniques and tools that science provides. With careful planning we can control most weed populations without selective herbicides and only rely on herbicides to eliminate the small percentage of weeds remaining. This reduces the pressure on herbicides and reduces the risk of developing resistance.

During our early years of no-till we relied too heavily on selective herbicides and resistance followed. Herbicides are one tool to assist in making the system work but they are not a system on their own. Conventional systems suffer weed competition and herbicide resistance the same as no-till does.

A weed is any plant growing where it is not wanted. Wheat is a weed in a lentil crop. Weeds have similar needs to crops, like sunlight, moisture and nutrients. Is it any wonder that weeds want to share the fertilisers, moisture and sunlight with our crops? We must think like plants and determine ways to give our crops an advantage over weeds.

Techniques used on Cloverlea Farms to fight weeds

1. Stubbles are prepared for seeding at harvest by cutting short and distributing straw and chaff as evenly as possible. Any weed seeds are evenly distributed and left on the soil surface.
2. Stubbles are not grazed to ensure weeds remain on the surface and the residue is left standing vertically, providing the Boomspray with better access to weeds.
3. Use non-selective knockdown herbicides before seeding.
4. Ensure seed and fertilisers are weed free.
5. Row spacing to suit selected crop and residue quantity.
6. Sowing action moves residue from drill row to inter-row space allowing more sunlight to crop row and shade over weeds in the inter-row space.
7. Apply residual herbicides before seeding and sweep drill rows clear to prevent any crop retardation by herbicides.
8. Band fertiliser in most advantageous position for crop and away from weed seeds.
9. Ensure banded fertiliser provides adequate nutrition for the crop but is not available to weeds.
10. Use press-wheels to ensure adequate seed to soil contact and ensure crop emerges ahead of weeds.
11. Do not cultivate or disturb the inter-row space in any way—no harrows or prickle-chains. All forms of disturbance stimulates weed germination.
12. Use diverse crop rotations including summer crops. Plan rotations with disease and weed control in mind. Healthy vigorous crops compete with weeds.
13. Sow paddocks with heaviest weed burdens last and try to kill a second germination before planting crop.
14. Select crop varieties with vigorous growth habits or competitive crops.
15. Rotate herbicide families.
16. Be certain herbicide residues from the previous season does not retard the current crop.

These techniques are currently working for us. You might need different methods. I'm sure that if you think carefully about the needs of the weeds and the crops you will come up with a system that works for you. Good luck!

Think differently for no-till

Jim Kirkwood, Kendenup (08) 9851 4153 p/f

Along with my wife Marlene and our son Chris and his wife Sally, I farm 1,400 ha of mostly duplex soils in 500 mm rainfall country, south of the Stirling Ranges. I learnt pretty quickly that no-till farming is a lot different than conventional cropping. During the 1998 WANTFA Study Tour of North America, the words of scientist Ardell Halvorson in Colorado summed up our experience with the recent adoption of no-till— 'you have to cleanse your mind of existing cropping procedures'.

Our first attempt at no-tilling in 1996 was a disaster. We had heard of no-till and thought that getting the right machinery was a big part of it—but we were wrong! We soon found that poorly prepared pastures and limited herbicide knowledge could be costly. We quickly employed Wayne Smith as our agronomist, and this was the best thing we have ever done for improved farm productivity.

Amazingly, with Wayne's advice, we were able to change some sad and weedy crops into being very profitable. They even went 3 t/ha due to a brew of herbicides. We also learnt that the boom-sprayer was the most important farm machine, not the seeder. We seed with Walker triple discs.

Agronomy important to success

We now know that crop agronomy is most important. Good paddock preparation years beforehand is critical for good yields to be achieved over the whole farm. Pasture and stubble management need to be planned at least the year before seeding. It has taken us several years to get some paddocks performing. But the rewarding thing is that we can see the positive changes. No-till really does create some exciting improvements in soil quality and farm management flexibility.

Getting weed numbers down and cleaning up root diseases are our main aims. For this to occur, I highly recommend that farmers employ a mobile agronomist—not one that just gives advice from the office phone. The things we need to know with herbicides are almost overwhelming, like; which herbicides can be mixed, what cost, residual effects, timing of application, what rates and which new chemicals might work.

Other agronomic issues also need addressing. These might include; NPK fertiliser rates for optimal production and trace element requirements with no-till; early detection of disease and insect problems; which new varieties would be best; what to do with wet or very sandy areas; and the interpretation of data. Having an agronomist on the job helps me to sleep better at nights, knowing that there are at least two heads thinking through the issues for maximum crop production.

Fully sustainable cropping

We hope to implement fully sustainable cropping systems and we can see that no-till is a big part of it. Last year we got rid of all of our sheep and can see this as being very positive. Our soil structure is improving and the ground is much more trafficable now. Grain yields are clearly increasing through time.

We have found attending the 1998 WANTFA study tour of North America and the Annual WANTFA Conference very beneficial.

Above: Jim Kirkwood shows, with surprise, how an ill-adapted variety of corn has done modestly well.

Below: Sorghum with other crops in background - millet in far right, corn in centre back, safflower far back and centre and sunflower back left.

After returning from North America last spring we decided to give warm season crops a go. We have been pleased and surprised at the results. Despite us being on a steep learning curve, we still managed to grow some near profitable crops in waterlogged failed faba bean country. We grew corn, millet, sorghum, sunflower and safflower. The grain sorghum did well and the corn surprised us. I think with more suited corn varieties, it has potential. The sunflower also did well on the heavier soils but was knocked around by the Rutherglen Bug. The safflower was disappointing, but otherwise all these crops grew well. The millet continued to stay green and keep growing into May.

Some of the better sunflowers on some of the heavier soils.

An interesting observation by a neighbour was that, where he had planted sorghum in flooded patches of a canola crop, the soil had dried out completely. In April a bulldozer was ripping a drain across the canola and sorghum areas and, in the low lying sorghum patches, the bulldozer was struggling to rip 65 cm as the soil was so dry. In contrast, he ripped through the canola stubble like a knife through butter. Some neutron moisture probes put in by Arjen Ryder from AGWEST Albany, at WANTFA's request, have shown that the soils have been dried to 1.2 m depth by April under these warm season crops. This gives the 1999 winter crops a better chance of surviving wet conditions.

I am confident that with a little more work we can make these warm season crops a part of our farming system. I am sure they will have a positive effect on slowing or perhaps even stopping the encroachment of salinity on our soils.