TO MEMBERS

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Western Australian No Tillage Farmers Association (Inc) WANTFA

JANUARY 1996 "NO TILLAGE—LEARN THIS CONSERVATION CROPPING SYSTEM" NEWSLETTER VOL 4 NO 1
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INDEX

Topical Section

QUOTABLE QUOTES

Various Contributors (090 761333 fax 227)

- WANTFA is a cult and a passing fad.
- Everyone is enthusiastic at times. Some have enthusiasm for thirty minutes, others have it for thirty days, but it is the person who has it for thirty years who makes a success of life.
- Faith is believing in spite of the evidence, and watching the evidence change.
- Change is first denied, then vehemently opposed, before being accepted as self evident.
- We cannot resist change, but we can choose the direction of change.
- I tried less tillage to prove this new idea wouldn't work!
- Stubble retention sure makes for hot fires.
- You can stop wind erosion with direct drill, but it's so easy with no-till!
- Cultivation, puddles and hot sun - isn't this how we make bricks?
- A pessimist is one who makes difficulties of his opportunities; an optimist is one who makes opportunities of his difficulties.
- A wise man delights in an honest rebuke.
- Those who say it can't be done shouldn't stand in the way of those who are doing it.
- Trying to change bureaucracy is like moving a cemetery, you get little help from those on the inside!
- Like promotes like, so be careful!
- Successful innovators are pragmatic, non dreamers who will 'try it now'. Organisations wishing to be successful must allow such innovators space to 'try it now'.
- The number one mortal sin for researchers is excessive quantification of the imponderable.
- When one rules in righteousness he is like the light of morning at sunrise on a cloudless morning, like the brightness after rain that brings the grass from the earth.

ANNUAL CONFERENCE AND AGM AT DARKAN 28-29 FEBRUARY

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

WANTFA's Annual Conference and AGM will be held at the Darkan Sporting Complex from Wed 28 to Thur 29 February 1996. Billeting for the night of the 28 can be requested through Greg Ricetti (097 36 3060 p/f). Hotel/Motel accommodation is also available at Darkan, Collie, Williams and other towns. The program is:

Wednesday 28 February, Chairman - Ray Harrington

9.30 am	Morning tea.
10.00 am	Welcome by Ken de Grussa.
10.10 am	Prof. Dwayne Beck, Director Dakota Lakes RS. South Dakota State University, "No-Till Crop Rotations in North America".
11.00 am	Questions.
11.15 am	Stephen Loss and Mark Sweetingham.
11.45 am	Questions.
12.00 noon	Greg Hamilton on developments since the September 1995 Crop Establishment Workshops.
12.15 pm	Questions.
12.30 pm	Lunch will be supplied and then view no-till seeder openers displayed by manufacturers and farmers.
1.30 pm	**Concurrent sessions.**

Session 1: **Getting started in no-till,** Chair: Ray Harrington. Possibly Tony White, Paul Maisey, Geoff Marshall, Steve King, Greg Ricetti from Darkan.

Session 2: **No-Till Crop Rotations,** Chair: Graeme Malcolm. Possibly Stuart McAlphine, Mick Christiansen or Toll Temby, Trevor Wilkins, Tim Trethowan and Steve Marshall.

3.00 pm	Afternoon tea.
3.30 pm	Allen Postlethwaite "No-till in the Wimmera".
4.00 pm	General discussion.
5.00 pm	Refreshments and view no-till seeder openers.
6.00 pm	Barbecue is supplied.

Thursday 29 February

7.30 am ***WANTFA AGM*** with the business of:

1. Receive the Committee's report
2. Receive the Treasurer's report
3. Elect (or re-elect) the President, Vice President and Committee members for the Northern and Central Agricultural Regions (currently Graeme Malcolm, Geoff Marshall and John Hicks).
4. Conduct any other business placed on the agenda before the commencement of the meeting.

10.00 am Morning tea
10.30 pm **Concurrent sessions**

Session 1: No-till rotations Chair: Dwayne Beck

Brain-storming possibilities for no-till crop rotations in Western Australia (if enough starters) and

Session 2: No-till sowing systems progress

Supervisory Team Meeting for GRDC Project

12.30 pm Lunch (supplied) and depart.

NEW NO-TILLERS BEWARE!

Bill Crabtree, Development Officer, Esperance (090 761333)

With the rapid adoption of no-till, some farmers may feel pressured into embracing no-till prematurely. Some have made costly mistakes by not getting the whole package right in the one go. However, many have successfully switched from direct drilling to no-till in one year, which is possible if you understand the main soil, plant and environmental factors for crop establishment.

In particular, for cereal growing, the important factors are having a bulky legume with grass weed control the year before. Purchasing an expensive no-till machine will not guarantee cropping success! Sometimes new machines do not arrive on time and there have been some costly losses due to a no back up strategy.

You and your neighbours need to know the fors and againsts of no-till sowing before changing systems. Be aware of potential down sides to no-till. The main ones usually are, less early crop vigour, more rhizoctonia, no second knock effect on weeds and more fertiliser toxicity. All these issues are addressed in previous WANTFA newsletters.

Many farmers I have spoken to are feeling pressured into embracing no-till, and I think it wise for us (WANTFA members and friends), to do what we can, to reduce that pressure. Pressure can force people into error and cropping errors can be costly. We know that no-till benefits are large and people are seeing these good crops all over our State.

Strong statements for no-till by farmers, others and myself have helped many adopt no-till. But now, the tide has turned, the no-till ball is rolling, perhaps the time has come to make louder noises about things that can go wrong. Perhaps we should temper our enthusiasm, for what we know to be right, for the benefit of those who could make costly mistakes.

As no-tillers, we should be careful to tell our story, as it is, and not exaggerate it. Peer pressure can be negative if it is not coupled with the cold, hard truth. Some farmers will be tempted to boast about their no-till yields to demonstrate that they are up with the times. Such boasting will do more harm than good; a humble but encouraging attitude is better. We do not want people adopting something now when it would be better if they adopted it the following year.

Old Newsletters Are Available

They have not dated! The Seven Newsletters, over the last three years, are still very relevant and are available in a folder for $25 each. These stories are frank and honest and should help new no-tillers avoid re-inventing the wheel and making costly mistakes.

For new membership and back copies of all newsletters published so far the cost is $35, for back copies only the cost is $25, for folders only the cost is $10 and for new membership only the cost is $20 (this will guarantee next years newsletters will be posted to you). Please send your money in the post to WANTFA c/- Kondinin Group, PO Box 913 CLOVERDALE 6105 (on 1800 677761).

AMERICAN NO-TILL SCIENTIST VISITS IN FEBRUARY-MARCH

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

Dr Dwayne Beck, Manager of the Dakota Lakes Research Centre of South Dakota State University, will be visiting Western Australia from 26 February to 8 March 1996. All ten of us on WANTFA's 1994 North American no-till study tour were impressed with Dwayne's no-till rotation trials and communication skills.

It is proposed to hold a series of afternoon seminars with Agriculture Western Australia and other speakers in the areas and on the dates shown below. For further information, contact the WANTFA Committee members or Agriculture Western Australia or other personnel shown above right:

Date	Area	Contact person	Phone	Fax
Mon 26 Feb	Merredin	Darryl Abbott	090 81 3111	1571
Tue 27 Feb	Northam	Mike Collins	096 226114	1902
Wed 28 Feb	Darkan	Greg Ricetti	097 36 3060	3060
Thur 29 Feb	Wellstead	Jim Baily	098 47 1036	1012
Fri 1 March	Lake Grace	Steve Curtin	098 65 1205	1282
Sat 2 Mar	Esperance	Ken de Grussa	090 78 2026	2007
Mon 4 Mar	Kalannie	Jeni Dodd	096 75 1050	2130
Thur 5 Mar	Morawa	Graeme Malcolm	099 71 5002	5035
Wed 6 Mar	Geraldton	Caroline Peek	099 21 0509	0816
Thur 7 Mar	Moora	Tony White	096 54 1025	1025

WANTFA is grateful to the Minister for Primary Industry, the Hon. Monty House, for making a $2,500 grant available to enable Dwayne's visit. Dwayne will also speak at the Cooperative Research Centre for Soil and Land Management in Adelaide and at the Wimmera Conservation Farming Association's Annual Seminar on 14 March at Longerenong Agricultural College near Horsham in Victoria.

NO-TILL FORERUNNERS IN WA

Kevin Bligh WANTFA Secretary,Perth (09 368 3893)

I have been fascinated to learn more of the early history of direct drilling and no-till sowing in Western Australia. I have received many comments from my October 1995 Newsletter article which honoured Australians and New Zealanders who ".... plugged on and worked with no-tillage through the 'lonely years' from the mid 1970s up to the formation of WANTFA in 1992".

Some believe a detailed crop establishment history should be written. Until that happens, I would like to help the no-till movement avoid repeating history, by discussing its origins in Western Australia.

It is clear that direct drilling was, and still is for many, the forerunner to no-till. WANTFA defines direct drilling as sowing with a full cut, using points or offset or culti-trash discs, without prior tillage. In contrast, no-till sowing is defined as sowing without rearranging the entire topsoil structure. One working prior to seeding is termed reduced tillage, and any more workings, multiple tillage.

ICI Australia Ltd., together with ICI subsidiary Plant Protection Ltd. (UK) started developing direct drilling in the 1960s, by marketing paraquat and diquat as Gramoxone® and Reglone. Farmers like **David Lefroy** of Moora, for example, used paraquat for grass seed-set control in pastures as early as 1963.

By 1969 some farmers, including the late **Fred Hamilton** of Moora and **Mike Brown** of Narrogin, were mixing paraquat and diquat, and trialing direct drilling using standard combine seed drills. Mike considers his move from multiple tillage to direct drilling far more difficult than his subsequent move to no-till. He has now used a Bettinson triple-disc drill continuously for 20 years, since 1976.

Other early direct-drill farmers included **Vin Kain** of Williams, **David Anderson** of Katanning, **Pell House** of Kojonup, **Les Colbrook** of Brookton and **John Hewett** of York. When asked about motivation, **Frank McGill** of Calingiri said he started direct drilling in 1971 "firstly to get a persistent ICI representative off my back, and secondly, because I wanted to prove this new idea would not work!"

ICI Australia Ltd. continued to develop direct drilling with over a 100 leading farmers in the early 1970s, with people like **Ian Fletcher** and **Bill Roy** of York prominent. In a concerted extension campaign, with public relations consultants like **Bill Quinn** rural newspapers throughout Australia were prompted to write articles on farmers' successful direct-drill systems.

Wimmera ryegrass loomed as a major problem in crops until Hoegrass® became available from Hoechst Australia Ltd. in the mid 1970s. Monsanto Australia Ltd. marketed glyphosate as Round-up® and introduced Western Australians to the phrase "no-till"!

Agriculture Western Australia conducted about 100 trials, initially on direct drilling in the late 1960s, including no-till using triple disc drills in the late 1970s. Principle weed agronomists ***Geoff Pearce, John Holmes*** and ***Mick Poole*** were centrally involved, comparing crop establishment, growth, weed control and yields. ***Geoff*** visited England in 1976 where he reported that no-till using narrow points or triple-discs, was a well established practice, also visiting Canada and the USA. On his return, he spear-headed the establishment of long term systems trials - especially regarding time of sowing and weed control - to study cumulative effects over many seasons.

Research officers ***David Tennant*** and ***Ann Hamblin*** began studying the effects of direct drilling and no-till on soil, exploring nitrogen mineralisation and plant growth in 1976. They then selected the long term trial sites on Wongan Hills, Merredin, Avondale (near Beverley), Mount Barker and Esperance Downs Research Stations. Direct drilling (using standard combines), no-till (triple disc drills) and the conventional tillage (of work-up, work back and seed) were compared under both continuous wheat and wheat:pasture rotations. ***David*** and ***Ann*** monitored soil moisture, nutrient and structural changes for several years. ***Gordon MacNish*** studied plant disease levels, and entomologist ***Phil Michael*** looked into webworm and other insect control techniques with direct drilling and no-till sowing.

John Holmes helped coordinate sowing on the five sites in 1977 and he also monitored weed numbers and species for several years. **Dave Jasper** coordinated activities and measured crop growth, yield and earthworms for the following two years. ***Ron Jarvis*** took over the management of the sites, getting crop and soil measurements from 1980. Most of the sites continued for 10 years, though the Merredin sandy clay loam sites were in their 19th year in 1995.

In 1978 an ICI project team, including **Roger Crook**, **David Rice,** ***Rick Madin,*** **Bruce Boddington,** ***Kevin Young*** and **Peter Borstel** propagated no-till sowing using the Bettinson triple-disc drills. They also floated the idea of using 50 mm wide points on combines, modified by removing cultivating tines. International liaison was maintained by people like **Ian Logan**.

Early no-till adopters like **Bruce Ivers** of Kojonup and **Richard Barbour** south of Collie appreciated the flexibility and time saving of no-till sowing using Bettinson triple disc drills. **Dale Metcalfe** of Dowerin observed that he used to work the soil, then work it back. Then it might get too wet, but he still had to puddle the crop in using a combine seed drill. Then the soil is out all summer under the blazing sun. "And isn't this how we make bricks?" asked Dale, pithily! He has direct drilled since.

Direct drilling fell into disrepute in some areas, however, perhaps largely because some farmers tried it on the last paddock at seeding, with lower yield potential anyway because of late sowing, more advanced weeds, boggy conditions or other problems. ICI farmer-advisers like **Frank McGill** tried to avoid such problems by encouraging potential clients not to direct drill until early the following year!

David Tennant and ***Ann Hamblin*** found that soil structure improved under reduced tillage on sandy loam soil at Avondale, and a sandy clay-loam at Merredin. Wongan Hills loamy sands however, became more compact under reduced tillage with restricted root growth.

Ron Jarvis then ***Bill Crabtree*** (Jerramungup) and ***Craig Henderson*** and ***Rob Delane*** (Geraldton) found that narrow (50 mm) points working deeper, could give comparable crop yields as multiple tillage on sandy soils. ***Ron*** discovered less rhizoctonia bare patch on wheat with these deep narrow points on Wongan loamy sands in 1983 and, with ***Ross Brennan*** (Albany) on sands at Esperance in 1984. ***Ron*** also showed in 1981, that ripping Wongan loamy sands 30 cm deep increased crop growth and yield.

Commercial manufacturers such as Chamberlain-John Deere Ltd. and, later, John Shearer Ltd., and other companies, produced combine seed drills capable of being adjusted to cultivate deeper than the sowing tines. Other companies such as Agrowplow Pty. Ltd., produced combine seed drills capable of adjustment to cultivate deeper than the sowing tines.

Geoff Pearce of Agriculture Western Australia estimated that up to 40% of cropland was direct drilled in 1983 - probably aided by the late break in most areas (17 June). ***Jeremy Lemon*** and ***Ron Jarvis*** found improved pasture regeneration after no-till at Avondale, Narrogin and then Esperance from 1983-85.

Improved lupin varieties and agronomy helped the rapid adoption of direct drilling in the early 1980s. ***Peter Nelson*** and ***John Hamblin*** of Agriculture Western Australia spearheaded extension of direct drilling lupins as a package in the Geraldton Region, and ***Mike Ewing*** and ***Steve Trevenen*** around Merredin. Plant pathologist ***Mark Sweetingham*** researched stubble retention and sowing depth control to minimise brown spot and root rot infections.

In the late 1980s, ***Ron Jarvis, Mike Bolland, Bob Belford, Rob Delane*** (Geraldton), ***Ross Brennan*** (Albany), ***Bill Crabtree*** and ***Mark Seymour*** (Esperance) and others, researched effects of deeper cultivation below the seed zone, or deep placement of phosphorous or manganese under lupins in direct drilling or no-till sowing.

Peter Nash publicised and extended direct drilling in the Central Agricultural Region. Soils researcher ***Tony Proffitt*** refined soil management recommendations, advising direct drilling structurally-degraded loamy soils for about three years, as a necessary first stage to avoid crop yield losses, particularly in the first year under no-till.

It is perhaps surprising that after almost a quarter of a century, only 19% of Western Australian farmers direct drilled in 1993 (Australian Bureau of Statistics). Another 2.4% used narrow points for no-till sowing and an estimated further 1.3% had bought disced no-till seeders. Only a handful of farmers had regularly used no-till in 1990. By 1995, no-till estimates were about 10% overall and at least 35% in southern areas.

An inherent hazard of writing a "potted history" is that you are bound to interpret events differently than some people and perhaps overlook or insufficiently recognise some major contributions. So I look forward to other people filling in gaps in the perception of a humble water erosion researcher in another issue of the Newsletter.

One thing is clear; no-till sowing minimises water erosion on cropland, and structural degradation of most Western Australian soils. With full stubble retention, no-till can also minimise wind erosion. As the Chairman of the Soil and Land Conservation Council (WA), and Jerramungup farmer **Rex Edmondson** observed three years ago; "You can stop wind erosion on cropland with direct drill, but it's so easy with no-till".

Any help we can get from our history to make profitable no-till systems more attractive to farmers is highly desirable. No-till sowing potentially enables sustainable cropping in the long term, for the benefit of future generations.

PROPOSED SECOND NORTH USA NO-TILL STUDY TOUR—SEP '96

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

Was the harvest good enough to pay for a tax deductible no-till study tour in the US and Canada next September? If so, expressions of interest in a Second WANTFA North American Study Tour, would be appreciated.

It is proposed to study no-till sowing in small-grain producing areas in the Northern and possibly Central Great Plains and the Pacific North-West of the US and the Canadian Prairies, for about three weeks next September (1996). A more landcare orientated tour in Southern California could follow in the following week.

Hired seven-seater vans would allow more freedom than being couped up in a bus for three weeks. We would just need a "Captain" to hire each vehicle, settling costs later. Groups of people could also join and depart at different points, if they so desired. Costs should be comparable, though drivers would have to stick to the right at all times - not like old Peterbilt here, who got a bit close to a truck in South Dakota last year. (Poor Diane Malcolm of Morawa was still pale an hour later!)

Total distances travelled will be large (about 10,000 km last year), leaving and returning to say, Denver, Colorado on 2 September, with Sundays as rest days, in say, Brandon, Manitoba, Kalispell, Montana and Yellowstone, Wyoming and up to six days of no-till visits and travel in between.

Dwayne Beck will be giving us a run-down on no-till sowing in South Dakota when he is here in February/March. Come along to one of his talks (see this Newsletter) to assess transferring principles of their no-till systems on the prairies to ours, though their soils, seasons and frequency of crops are different.

Or you may wish to talk to a participant in the 1994 tour to better assess the proposed 1996 one. I am taking the liberty of including their names and phone numbers, on the assumption that would be happy talking to you about it. John Cunningham on 099 71 4015, Graeme Malcolm on 099 71 5002, Tony White on 096 54 1025, Bruce Hobbs on 096 42 1075, Ray Honey on 097 32 2063, Ray Harrington on 097 36 3030, Darryl Hine on 098 47 1022 and Garry Hine on 098 47 2035.

Please let me know by 31 January, if possible, if you or your partner are thinking of taking part in the tour. About a dozen people have expressed an interest so far. Diane Malcolm was the only wife who joined the party last trip. Wives and families could also arrive at the end for a later holiday trip.

There is a lot of no-till farming talk at each visit. The relatively long travel times allow friendly banter for relaxation, as well as talking "shop" along the way, of course. Economical and fairly roomy Ford Aerostar seven-seater vans (from Budget Rent-a-car) would allow the freedom to make our own accommodation and meal arrangements, until meeting at the next address, the next day or whenever, making for a more flexible and enjoyable tour.

Ballpark cost estimates would include, say, $2500 per person for (privately arranged) return air fares and say, $100 per person per day for accommodation, meals, transport and other costs. The Australian Taxation Office advise that the cost of a study tour "would be an allowable tax deduction if the subject of self education, being in this case no-till, is directly relevant to the activities by which assessable income is currently derived".

WHEN IS TILLAGE NECESSARY IN QLD

Bruce Radford, QDI Research Station, Biloela

This story was taken from "The Conservation Farmer" June 1995. While there are noticeable differences in environments, particularly their very heavy soil types, this article is still timely and useful for us here in WA (end editor). The article in the last issue (April 1995) "No Trade-offs for Zero-Till" prompts the question "When should a conservation farmer till the soil?" There are several circumstances when tillage practices become necessary in a sustainable farming system.

Problem weeds: Certain weed species are difficult to control with herbicides but can be controlled mechanically, like bitter bark and black wattle. Mature weeds or weeds suffering moisture stress are also difficult to control chemically. Continuous zero till will result in a new spectrum of weeds suited to survival under the new regime. Some of these weeds will develop herbicide resistance if the same herbicide is applied over a long period of time. If alternative chemical control is not available, mechanical control becomes the only option.

No ground cover: During a long drought such as the current one, ground cover may be lost until there is no soil protection whatever. Under these circumstances, the best way to get rainfall into the soil is to use tillage implements to break up surface crusts and to roughen the soil surface. Research results have shown that a zero tillage treatment with all the stubble removed gives poor water storage and consequently low grain yields.

Accumulation of nutrients in the surface soil: Research has shown that immobile nutrient soil elements (like P, K and Zn) become concentrated in the top few centimetres after about four years of continuous zero till. Because plant roots rarely enter this layer, these nutrients are left stranded in dry soil and are unavailable for crop growth. On soils with low levels of these nutrients, deficiency symptoms appear and yields decline. The application of fertiliser is generally uneconomic whereas tillage to mix the nutrient-rich surface soil into the lower layers quickly overcomes the problem.

Establishment problems: While crop establishment after zero tillage is not usually a problem if up-to-date technol-

ogy is used, certain soil types do present problems and require some seedbed preparation. Tillage may also be needed to level the ground after harvesting or spraying operations in wet conditions. On self-mulching soils this is less of an issue as wheel tracks disappear with time. Such levelling is important when the crop to be sown is sensitive to sowing depth or the planter to be used has poor depth control. Controlled traffic farming in conjunction with zero tillage is a way of avoiding problem wheel tracks.

Erosion rills: Zero tillage dramatically reduces soil erosion, but when high-intensity rainfall events occur, rills will form. Tillage is needed to fill in the rills and prevent further run-off and land degradation.

So no grower can afford to throw away his tillage implements altogether. With a bit of thought, a single operation can be used to address several of the above issues at the one time. Operations should be timed to avoid the period of high-intensity summer storms in order to minimise the detrimental effects of soil disturbance. *(Editor - I think there are some environments in WA where some tillage implements can be scrapped!)*

REPORT ON TRAINING COURSE IN HOLISTIC RESOURCE MANAGEMENT

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

(W)holistic management begins and ends with the quality of life and forms of production we want and the landscape we plan to pass on to further generations.

Eleven of us took the nine day training course held at Perth and Beverley in October (see October '95 WANTFA Newsletter) including five spouses. Family communication is improved and tensions can be eased by developing the holistic goal together.

The first three days of the training course include steps in setting the goal and writing it down for clarity. Decision making is discussed in detail in the biological systems farmers operate in.

The second three days concentrate on biological monitoring and land and grazing planning. The Holistic Resource Management model assumes that every decision, though made on the best available advice is wrong. Therefore, effects are continually monitored and corrective action taken immediately we find we are wrong.

No-till sowing is one of the tools that may or may not help us to reach our goal - of our desired quality of life, forms of production and future landscape. The model includes seven tests as to whether no-till, for example, is the best means of achieving our goal. Many no-till farmers have probably already done that! The model offers a formal methodical way of doing it!

The final two days concentrate on farm financial management. Real wealth is assessed in detail. For example, if crop yield is increased but soil organic matter is reduced in the process, the costs of the nitrogen and other benefits lost in the organic matter are included. Again, you plan assuming you're wrong; monitor; and adjust the plan accordingly - and continually repeat the process.

The last day is an on-farm consulting visit by Bruce Ward of the Moree (NSW) District Business Centre, who runs the Training Course. The personal visit can help in getting started on applying the model from Bruce's already extensive experience.

Holistic Management was developed in Africa and America, in an attempt to solve a problem. The problem was simple - why, despite all the knowledge and technology available to us - the most that the world has ever seen - is degradation continuing and even accelerating? Allan Savory, the Zimbabwean born biologist who developed the process, recognised that the way we make decisions seems to be at the bottom of the problem.

Nobody deliberately makes a wrong decision about their land, yet it seems that the cumulative effect of many decisions, each of which is absolutely correct in the short term, is degradation in the long term. Holistic management ensures that decisions affecting the land are, to the best of our ability socially, ecologically and economically sound in the long term.

In arid environments, the use of animals is often involved - raising questions about possibilities for perennial pastures. The model applies business principles in, again, planning, closely monitoring results and re-planning. The principles also apply to any business.

The Moree District Business Centre offered myself (of Agriculture Western Australia and as WANTFA Secretary) and Peter Berg (of the Victoria Department of Conservation and Natural Resources, and Treasurer of the Wimmera Conservation Farming Association) two for the price of one ($2100) attendance at the nine day Training Course. While neither of our employers approved in time to participate, I was able to take leave and attend privately as a part-time farmer, with my wife. (RAFCOR may pass on a federal subsidy to attend - up to 50% of approved course fee, less meals - to more than half time farmers).

Further Holistic Resource Management Introductory Courses are planned for various locations in Western Australia in the week commencing 25 February 1996. If you are interested in inquiring further, I suggest that you take the one-day Introductory Course first - to help you decide whether you want to do the full nine-day Training Course. Dates for the Training Courses are 9-11 March, probably in Perth, 20-22 April and 26-27 April. Enquiries: Suzie Ward or Lennie Chaplain, Ph: (067) 524 100, Fax: 5010.

Science Section

TRIFLURALIN FACTS AND TIPS

Steve Curtin, District Leader, Lake Grace (098 651205)

The development of no-till farming systems and herbicide resistance has seen the re-emergence of trifluralin as a popular chemical for ryegrass control. Our trial work (see May 1995 Newsletter), and farmer experience shows that trifluralin goes a long way to keeping ryegrass under control in conjunction with no-tilling. However, it is still only one of many tools we need to use in weed control!

Trifluralin is safer, and can be more effective, in a no-till system compared to a cultivation system. This article summarises what we know about trifluralin and how we can get the best out of it in a no-till sowing system.

Trifluralin is volatile, and if left on the ground and exposed to air, then it will virtually float off. High temperatures and sunlight increase the rate of volatilisation. trifluralin usually lasts 2-3 weeks. It stays as a vapour in the soil and is relatively immobile and insoluble. It tends to move up rather than down and is not bound to the soil.

Soil type is also important in that trifluralin will volatilise more easily from lighter soils due to bigger pore spaces. It also means that it can be more effective on lighter soils due to a higher concentration of vapour. In soils that crust, the crust traps the vapour and trifluralin is more effective but can also be more damaging to crop plants.

Trifluralin is absorbed by emerging plant roots as a vapour in the soil which then inhibits cell division. It causes slow coleoptile emergence and elongation, and pruning of roots. If weeds are not stopped at this point then they will grow on, although less vigorously. For trifluralin to be effective weed seeds must end up either in the trifluralin band or above the band. If the weeds are below the band then the weed will establish a root system and grow through the trifluralin layer.

Trifluralin is more effective in a narrow concentrated band so long as that is where the weed seeds are. Recent work shows that trifluralin is not absorbed on a dry seed surface in a way that affects weed germination. trifluralin at 2 L/ha has proven robust if applied correctly.

For trifluralin incorporation, try to avoid heavy harrows, but use light harrows to incorporate after no-till seeding and press wheels alone. Heavy harrows, like the Phoenix, can break up the inter row and incorporate trifluralin too deep, and damage cereals. While incorporating trifluralin post sowing with harrows is safer on the crop, it is less effective on ryegrass. Press wheels do not move trifluralin over the sowing row and ryegrass can emerge in the rows. Light harrows, or a covering chain, will put some treated soil back over the seeded row.

Try and avoid full-cut sowing and machines that do not give an even sowing depth. If the soils are responsive to cultivation then either try a deep, knife point or do not rely on trifluralin to do a good job with cultivation. Full-cut working increases ryegrass germination and redistributes seeds down the profile making trifluralin less effective. Also do not expect trifluralin to work well in paddocks with more stubble than about 25% ground cover.

No-till gives more accurate seeding depth with less variability. Knife point no-till systems place trifluralin in a narrow band where the weed seeds are. But be sure to check how much soil gets thrown onto the inter row. Soil throw is dependant on point angle and width, speed, soil type and moisture and row spacing. Perhaps a row spacing of 200-270 mm might be favoured for adequate soil throw, in most conditions.

If you are confident about seed placement and soil throw then 2 L/ha of trifluralin will be safe. Up to 3 L/ha has been safe in trials. Be sure to incorporate trifluralin quickly or spray at night when weather conditions are cooler. Some farmers are planning to put a boom on their seeders, like many did in the early 1980's. Finally, increase seeding rates by 10% as an insurance against unforseen damage.

We look forward to hearing your trifluralin stories in future WANTFA newsletters. I will let you know how our 1995 demonstrations worked by putting them in the next issue.

STUBBLES CAN PROTECT LUPINS FROM APHIDS

Francoise Berlandier, Entomologist, South Perth (09 368 3247)

It has been suspected for many years (see below) that some aphid species are repelled by cereal stubbles, as they are repelled by other types of ground cover. However, this idea has not been tested with our common lupin aphids before. There are three main species of aphids that attack our lupins; cowpea, green peach and bluegreen.

It is generally believed that aphids are repelled by stubble due to light emissions from the straw. Reflected light repels some species of aphids and more light is reflected from straw than from bare earth.

The extent of damage that aphids cause lupins varies between seasons, but losses can be severe. Lupins are most vulnerable to aphids during flowering, as heavy feeding damage on growing tips can cause wilting, buds to drop, flowers to abort and poor pod set. Aphids also transmit viruses which seriously damage lupins (see below).

Aphids reproduce rapidly. A mature female can produce up to 3 young per day, and new-born nymphs mature in 10-14 days in good conditions, like in 1995. Small population of aphids can 'explode' into hundreds within weeks. Aphids thrive in mild conditions, particularly during late winter and spring.

We know little about the landing behaviour of lupin aphids, although we do have indirect evidence from virus-spread information. The adoption of wider rows (to 36 cm) and no-till improves the ability of farmers to sow through cereal stubbles. Wider rows may alter aphid landing behaviour, aphid infestation and virus spread. Also aphids may respond differently to different stubble levels.

Studies elsewhere show that in some species, fewer aphids land where there is more ground cover. Western Australian trials by Jones, Bwye and Proudlove on BYMV and CMV spread in lupins show that wide rows and bare earth between plant rows can increase viral incidence over where stubble is retained.

I conducted a trial this year to look at how stubble retention, row spacing and soil type affect aphid landing behaviour. Gungurru lupins were sown at 40 kg/ha in mid and late June at Badgingarra. The low seeding rate was used to prolong the effect of the row spacing and stubble treatments. A bare earth and grey sand was compared to straw applied with narrow or wide rows. Aphids were collected every 2-3 days in water traps in all plots.

Up to three times more total aphids of all species were caught in traps in the bare earth plots than those with stubble. The differences were greater early in the season while there were large gaps between young plants. However, not all aphid species responded in the same way.

Both green peach and turnip aphids were more attracted to lupins which had bare earth between rows than where straw was applied, but oat aphid was more attracted to plots with stubble. Turnip aphid attacks wild radish and oats aphid attacks cereals, neither colonises lupin plants. However, because both species occur in large numbers around lupin crops, they may be involved in transmitting lupins viruses. The overall differences in aphid numbers between bare earth and stubble treatments decreased as the canopy closed, which occurred at the end of August, after the mid June sowing.

Here is another good reason to retain cereal stubbles when sowing lupins. Stubbles can offer some aphid protection, especially if aphids arrive early in the season while there is less canopy and when the crop is particularly vulnerable.

STUBBLE AND EARLY CANOPY REDUCE VIRUS SPREAD IN LUPINS

Roger Jones, Perth (09 3683269) and Annette Bwye and Wayne Proudlove, Geraldton

As Francoise mentions above, ground cover has been known to reduce incoming aphids. The earliest recorded work was in the 1920's in Africa and where ground cover reduced virus spread in a grain legume. Specifically, there were less cowpea aphids landing to transmit the peanut rosette virus. However, the same principles apply with other combinations of aphids, virus diseases and grain legumes. The ground cover can be stubble, crop canopy or weeds as all these deter aphids landing and spreading viruses.

Both ourselves and Francoise have studied the effects of stubble and early crop canopy on aphid activity. Our work goes further to show that stubble and an early canopy reduces the spread of cucumber mosaic and bean yellow mosaic viruses in lupin crops. Thick stubbles of 4 t/ha work best, but even 1 t/ha helps to reduce virus spread.

Stubble benefits are greatest in late-sown crops, at low seeding rates, with wide row spacing, and when aphids arrive early. Incoming aphids are most attracted to plants with plenty of visible bare earth around them. Stubble reduces incoming aphids and thereby reduces virus spread and has given significant grain yield increases.

Closer row spacings and higher seeding rates increase early canopy cover, which decreases virus spread in most years. Thick canopies reduce green peach and cowpea landing rates. Although we realise that farmers may need to go to wide rows to sow lupins with tined implements. Therefore with wide rows stubble rention is important. Disc seeders can seed through thick stubbles at closer row spacings.

Canopies also shade out infected plants which act as sources of virus infection. However, even with early sowing, high seeding rates and narrow rows, virus spread is not reduced if the aphids arrive before the canopy develops. In these years, stubble greatly assists in reducing virus spread. For further details see Department of Agriculture Bulletin No. 4294 and the December issue of the Western Australian Journal of Agriculture.

DO SHEEP COMPLEMENT NO-TILL?

Bill Crabtree, Development Officer, Esperance (090761333)

Perhaps it depends on where you are, what is your climate, soils, attitude, preference for sheep versus crop, water supply, infrastructure, breed, belief in long term wool value and many other factors. But there is a growing trend among croppers to move out of sheep and there are some good reasons for this. However, trend clashes with the view that these enterprises are intimately dependent on each other.

While crops do complement sheep management in many ways, there is a strong argument that, sheep do not adequately complement cropping. In fact sheep can frustrate cropping and

this was clearly demonstrated in Esperance this year. Rain from cyclone Bobby gave a 'good green pick' for sheep, but when sprayed, grain yields were increased by 1-2 t/ha. At $180/t it is not hard to do the sums; not spraying because of sheep cost a lot!

Conversely, there are benefits to having sheep and pastures on farms. Sheep make two harvests instead of one; they reduce peak activity with low operating capital. Where profitable pulse crops are not yet available, medics or subclovers (on waterlogging soils) are essential, making grazing sensible. Pastures also have soil-improving qualities. Also sheep do graze hard-to-kill-weeds and complement phenoxy herbicide use, they take grasses out of pastures (being a herbicide resistance tool) and they use chaff collected from harvesters.

Before changing a farm system away from sheep we need to think through the issues. I hope this article helps to do this. Perhaps the three most important negatives of keeping sheep are soil damage, compromised paddock preparation and delayed time of sowing. Specifically, sheep are not good for erosion, soil structure, weed movement, early weed control, soil biology, timing of crop activities, holidays and water management.

It is difficult to graze sheep on soils without wind erosion, or graze sheep on wet clays without causing surface damage. Wind erosion is a statewide problem, and we have many shallow soils which we can not afford to loose. Sheep regularly camp on the barest parts of the paddock, loosening the surface and encouraging erosion. Sheep are mobile and their feet are able to loosen a lot of soil. Sheep also create permanent tracks across no-tilled paddocks which can deepen through years, providing an erosion focus and can require cultivation to fill in.

Sheep also eat, trample and dislodge stubble, which can then blow against fences and damage them. Stubble lost to grazing, is also lost to the soil, as an important soil conditioner, which provides food for earthworms and other soil microbes. These small animals create air pores and channels, thereby improving soil structure and slowly releasing plant nutrients. Stubble also provides biocontrol of many soil pathogens and reduces leaf diseases of following crops. Stubble, while being a partial barrier to some herbicides, also reduces sand splash improving herbicide contact and activity on broad-leafed weeds.

Having sheep discourages an autumn herbicide use, because this feed is important for sheep. Unsprayed autumn pastures dry the soil, produce more insects, increase root diseases and make soil clods. All hinder good crop establishment. Early grown weeds are hard to kill, particularly capeweed, and require high rates of knockdown herbicides.

Sheep also spread weeds and insects across and between paddocks. Weeds can be bought in with sheep from other areas or regions, in the wool or the faeces. More commonly hay or coarse grains are bought in to feed sheep, may contain unwanted plant seeds. Also insects build up in pastures more than in crops, particularly red legged earth mite which proliferates on pastures with more than 3 t/ha of dry matter. Other insects also harbour in pastures and can make cropping more difficult.

Even though sheep require less capital outlay than cropping, they do require a lot of management. Sheep need water, fences, sheds, and several yearly treatments. Sheep need careful summer management which can limit a proper summer holiday. When on holiday a farmer may not be in holiday mode, as he reflects on what problems the recent weather may have caused for his sheep, which may prompt an evening phone call to a neighbour.

From another angle, there are at least two negative effects no-tilling has on sheep management. No-till reduces run-off, particularly as soil structure improves, perhaps giving only 10-25% of the run-off from a cultivated paddock. Consequently no-till farmers find they need to improve their catchments, and cannot rely on paddock run-off. The second problem, which can occur with any better cropping technique, is soft-seeded clover caused by spray topping, particularly if glyphosate is used. Too much clover may germinate on a false break.

There are other ways of reducing the problems associated with sheep management than getting rid of sheep. Treating the two activities as separate and overlapping them sparingly and thoughtfully is an alternative. The value of feedlots has probably been underestimated by many. Feedlots give management control otherwise not available.

Obviously the returns for wool are an important factor in this whole equation. Perhaps some people moving away from wool will enable those who remain to achieve better prices. Growers frustration of successive poor wool prices has caused many, even on the south coast, to consider the no-sheep option. I believe no-sheep is a viable option if your soils can grow break-even pulse crops.

There are numerous farmers Statewide who have no sheep and are often vocal at cropping field days against sheep. However, there are many prominent and successful no-tillers who are keen to continue producing wool. Many farmers like managing sheep and they probably should stay sheep growers, as they will do it well. However, positive world grain markets show long term encouragement for many crops, and continuous cropping is thought more sustainable than once thought.

NO-TILL = NO CEREAL VIGOUR!

Bill Crabtree, Development Officer, Esperance (090 761333)

In some situations, poor cereal vigour is not important, but in others it is. Poor early vigour usually associated with no-tilling is irrelevant, if final grains yields are not affected. No-tilled yields are often not affected where ther is high residual nitrogen, longer seasons, on soils that do not respond to tillage and where a clay base is within perhaps a metre. However, for those environments where final yields are reduced with poor early vigour after no-tilling, then here are some tips that might improve things.

Less early crop vigour is important on some soils, where organic nitrogen supply is low, with poor soil structure, moderate insect activity, stored moisture is deep and where the finish to the season is harsh. On south coastal duplex soils we are surprised at how well the slow and weaker no-tilled crops catch up by the end of the year. Perhaps this does not happen in some shorter-season areas, on deeper soils where the roots cannot keep up with the wetting front.

High soil organic levels, combined with a bulky legume the year before no-tilling, can release enough nitrogen to give adequate cereal vigour. The steady nitrogen supply to an organically fed crop is likely to have benefits over those fed more inorganically. The nitrogen flush created by cultivation does boost early cereal growth, and topdressed nitrogen helps to maintain the potential. But perhaps cereals prefer a steady and continuous supply of nitrogen.

We have observed in some trials, conventional plots going yellow at flag leaf emergence, while no-tilled plots stay green. This must have implications for grain quality! Given that the yields were similar, it makes you wonder about the need for a nitrogen flush early for some environments. Work by Wayne Smith and Mel Mason has shown many negative responses to applied nitrogen on wheat after lupins on the South Coast, with full cut direct drilling.

With no-till sowing, we probably need more nitrogen drilled early and less topdressed after sowing. The problem then is toxicity, particularly with wider rows. Mel Mason's article in the last newsletter highlighted the problem. Interestingly, if we are clever enough there are always ways around problems. Keith Head from Canada has quoted that 200 kg/ha of urea on 350 mm (12") row spacings for canola crops on a range of soils sown with the Conservapak, has not given toxicity provided the urea was placed slightly (15-20 mm) to the side or below the seed.

I am continuing to hear reports throughout Western Australia that no-tilled crops give low screenings. This makes sense as less early vigour with no-till and slow nitrogen release, means less tillers with less grains per tiller, and therefore, you might argue, less potential yield. However, the yields are often similar. Therefore our traditional rationale of 'creating a nitrogen flush and applying nitrogen after seeding to set-up yield potential early' must be reconsidered in the light of new observations.

How often 'in the real world' is potential yield really set in the first 6 weeks of growth? I think that yield potential is being set continuously. If you grow lots of tissue early, and produce lots of tillers, it does not mean a cereal has the potential to produce more yield! It could mean the crop is setting itself up for failure, producing within the plant, a desire to grow beyond its means to survive the regular drought in late spring. I wonder if this theory came from non-Mediterranean environments.

On poorly structured soils, a cultivation may be needed to enable plants to grow into softened soil before the soil sets hard again. However, these are the very soils that most need to be no-tilled to improve long term soil structure. Using gypsum and adopting less tillage may be a first step in the direction of sustainable cropping. On tillage-responsive soils, until we gain more experience and a better understanding, knife points are more appropriate than disc machines (see October 1995 newsletter).

Pastures harbour and breed more insects than crops grown in rotation. Alan and Matthew Jones of Esperance who continuously crop their whole farm never suffer from red legged earth mite damage, except for the first 100 m along the edge of a paddock adjacent to their neighbour who has pasture. It is a common observation that no-tilled crops are more susceptible to insect damage due to poor vigour and an undisturbed soil surface, leaving insect habitats more intact.

In wet years, no-tilled crops are able to release nutrients, because the microbes in the soil are active in wet soil, and therefore release nutrients. In these wet years the more slowly, organically-released nitrogen is also less likely to leach, compared to the flushed nitrogen from tilled soils.

In dry finishes, less early crop vigour may mean less potential yield loss. Since water that was not used early is available for finishing plant growth, and not having tillage induced nitrogen flush could be beneficial. Since no-tilled crops have less vigour, they use less water early and are less prone to haying off in a dry finish. Also many crops in dry regions and seasons can suffer yield loss from any added nitrogen.

So if you now think you have not prepared your paddock for no-tilling next year what should you do? You do not have to no-till. You can rip the country up first. (It's not a sin!) Tillage is a valuable tool that we are unlikely to ever throw away completely in all environments. If you do still plan to no-till, now that you perhaps more aware of some of the factors, tread with caution in these specific areas.

Here is an interesting nitrogen issue aside. A regular no-tiller of 3-4 years experience cultivated a paddock this year that had been no-tilled for several years and it produced an amazing bulk of crop. The crop vigour was way ahead of no-tilled crops. This is to be expected, as the organic material that he had built up had released a lot of nitrogen through the cultivation. It will be interesting to hear what happens after harvest. Will it live up to the good yield expectation? Remember to think of the long term implications!

CROP ESTABLISHMENT WORKSHOPS

Ken de Grussa, WANTFA President, Esperance (090 782026)

Early this year the Minister for Primary Industries, the Hon Monty House initiated a series of three workshops in different regions on crop establishment. The aim of the workshops was to get all parties with interests in crop establishment working together. Coordinated by Greg Hamilton (of Agriculture Western Australia), one farmer, 7 scientists and later WANTFA, the workshops were held in September at Jerramungup, Kellerberin and Three Springs.

At each Workshop two people were elected onto an implementation committee, to be set up to oversee Agriculture Western Australia's research and extension on crop establishment. We are hopeful that this committee will be able to steer sustainable cropping in the right direction. Also at these workshops, farmers and Development Officers, spoke on the benefits of least tillage cropping practices. The following four talks are from those Workshops.

CROP ESTABLISHMENT SYSTEMS FOR SOUTH COAST SUSTAINABILITY

Bill Crabtree, Development Officer, Esperance (090 761333)

The high yielding cropping package adopted by farmers on the south coast in the late 1980s created some cropping nightmares. Farmers were unable to sow lupins into thick wheat stubbles and no other technique was deemed viable or sustainable, these being:

1. burn the stubble and keep using tines - makes the soil too wind erosion prone,
2. sow with a cultitrash - too imprecise, poor emergence, higher seed rates needed, not furrow sowing and BR maggot,
3. topdress and skim plough lupins in - as above or
4. slash and graze hard - tines still block, stock suffer and wind erosion on patches.

Sowing into untreated lupin stubbles can also block seeders with tall lupins. Raking lupin stubbles is not a good option due to wind erosion. Wireweed and melons are also common weeds that grow on lupin stubbles and conventional seeders cannot seed through them.

Therefore numerous central south coast farmers, with encouragement from David Rees, Wayne Smith and the Jerramungup office, opted for double disc machines in 1991. This went against some early research data which showed how no-till or double disc machines usually yield 10-25% less than conventional systems or modified combines on sandy soils. However, earlier work was different from what no-till farmers were and still are doing.

The early trials were sown with a double disc machine, without press wheels or deep coulters, were usually sown into pasture and not lupins, had a time of sowing that was made to suit all machines, knife points were not used, showed no-till in short season environments performed worse, stubble was not retained (as it did not suit all machines) and herbicide techniques were still being refined (although less problems with double disc machines).

Rhizoctonia was also emphasised as an important yield limiting factor with no-till. However, more recent trials from 1992-95 have shown only small differences for tillage techniques. The deep knife points (even the very narrow ones) and the wavy disc compares favourably with the modified combine for early crop vigour and rhizoctonia control.

Some farmers get little rhizoctonia and those that get it bad find it is often only 10% of the farm that has significant patches. In these patches up to 50% grain yield reduction may occur and some farmers say that they can live with that. This is only a 5% yield loss over the whole farm, but remember the earlier whole farm time of sowing. It is worse where zinc deficiency, high pH and use of sulfonyl ureas are combined. Recent South Australian long term trial work has shown that retained stubbles have suppressed both rhizoctonia and take-all in a range of rotations.

When based at Jerramungup from 1985-87, I found that sometimes direct drilling with narrow points (50 mm), being the least tillage I used, gave equal grain yield to an in-line cultivation at 6-10 cm depth. Interestingly at 3 of 4 sites emergence was better when the seed was placed onto firm and undisturbed soil. Ric Hurst was observing similarly and was achieving 4 t/ha wheat yields with shallow knife points. Geoff Bee also had impressive crops even on his difficult, hard moort clays. Both Geoff's and Ric's crops had lots of earthworms and had clean and thick legumes the year before their cereals.

Neither Geoff nor Ric were keen to do a cultivation comparison trial with me in 1986. It was not important to them that they might be losing 1-10% yield from these practices as their system benefits were too obvious to them - but not to me. Geoff argued that if he stopped only 5% of his farm from blowing then he was happy. Geoff and I had strong words over this issue. I am now thankful that Geoff made me think hard, and about more than just grain yields from same-day-sowing trial results. His runs were on the board and both these farmers had good whole farm yields.

Responses to deep tillage (30 cm), during this time, showed only small benefits on a district basis. There were too few soils deep enough to give significant responses. Usually

only parts of paddocks in the Jerramungup area could be found where ripping responses might occur. Sometimes even deep sands did not respond to deep tillage. Problems with poor trafficability on shallow duplex soils that easily waterlog, and bringing rocks to the surface, soon cured my enthusiasm for deep ripping on the south coast. Some sites remained soft for several years - impairing trafficability.

These experiences taught me that agronomic factors, other than tillage, were more important for reaching yield potential's. The things that Kevin Young was finding with his barley work in the mid 80s, where he was growing 5 t/ha and a few years later, Wayne Smith with 4 t/ha wheat crops. Peter King from South Australia was also talking 6 t/ha opportunities in similar environments. Their keys were: low take-all, healthy legumes the year before, early sowing, longer season varieties, adequate phosphorus and aphid control (Grimm) and foliar disease control (Smith, Peters and Burgess).

When the most important yield limiting factors are overcome, benefits for tilling appeared to be minimal, except in a few environments. In fact the benefits of no-till, other than stubble retention, become obvious, and now many farmers wonder why they did not embrace the system before. This is where we are at now! The incredible adoption of no-till this year is unprecedented, with adoption perhaps doubling for the fifth consecutive year. Conservatively, perhaps 35% of south coast crops were sown with no-till this year.

Whole farm benefits of no-till sowing are perceived to be numerous. Here is an incomplete list of 15 factors. It includes better whole farm time of sowing; sowing can be done on less moisture; almost no soil erosion with less emotional stress; more time to manage crops and family life better; greater flexibility with soil or paddock management; stubble can be retained; improved soil biology, physics and chemistry; better trafficability at and after sowing; less screenings in cereals; strategic use of no-till machines (for reseeding and seeding small and expensive seeds); off peak use of machines for problem sites with neighbourhood sharing, has encouraged others to take the step to direct drilling; furrow sowing always occurs with no-till and catches water; less capital, fuel and maintenance required and other herbicide options appear (gramoxone, trifuralin, simazine, metribuzin).

There are also some issues that new no-tillers need to be aware of, including, more rhizoctonia (but deep knife or wavy discs help), less early vigour and N release (add some N), need good legumes to drive N release, more fertiliser toxicity (especially with wider rows), furrows can flood and wash simazine applied after seeding into furrows, some soils need more tillage than others and root lesion nematode can respond to tillage.

Farmers on the south coast are well aware of the need to conserve their soils, and no-till has had a big impact this year where strong persistent winds have occurred at and after sowing. There have been some small exceptions to this rule, which some critics have been quick to point out. However, any cultivation, particularly on sandy soils, predisposes us to erosion.

The whole farm system benefits do greatly outweigh the possible negatives for no-till. Farmers have generally given their vote of confidence for the no-till and stubble retention systems by swinging quickly into this resurrected but improved technique. This has been despite some significant opposition.

An apt quote to finish might be: change is first denied, then vehemently opposed, before being accepted as self evident. May I suggest that we are through the first two stages of the current revolution in tillage strategies.

NORTHERN PERSPECTIVES ON FARMING SYSTEMS SUSTAINABILITY

Peter Norris, Development Officer, Three Springs (099 541130)

There are three major farming systems in our Northern agricultural region. The high-medium rainfall grazing systems in the West Midlands area are dominated by sandy soils, with some intensive horticulture and aquaculture enterprises dotted throughout wherever water will allow.

Secondly, the medium rainfall sandplain cropping systems, range from Eradu, Mingenew to Wongan Hills sandplain and other areas of intensely cropped sandy soils. The wheat:lupin rotation dominates on these soil types.

Thirdly the medium-low rainfall heavy soils cover the rest of the Northern region not outlined above. These areas are dominated by cereal crops and pastures with pulse crops finding a place in this system. Continuous wheat or wheat:pasture rotations have been conventional practice in much of this zone.

Each system has degradation hazards that vary because of the nature of the different soils. However, the processes of land degradation below can be found in each of these systems. They include, wind and water erosion, acidity, herbicide resistance, soil fertility decline, salinity, waterway degradation, remnant vegetation decline, non wetting soils, soil structure decline and waterlogging with flooding and inundation in some years.

Farming systems of the past were often causing some of these types of land degradation. This fact has made many farmers re-think the way they farm. The Landcare movement has brought this to everyone's attention and is helping to reverse some of the damage.

New technology has allowed major changes to farming systems. Knockdown herbicides have allowed direct drilling. Other technologies like new crop species, herbicide resistant crops and alley farming will ensure our farming systems will continue to change in the foreseeable future. No-till crop establishment is one component of making our farming systems more sustainable.

Australian Bureau of Statistics show in 1993-94 that the area of no-till sown crop was 0.29 Mha (5% of all WA crops) with direct drill crops being 1.08 Mha (19% of all crops). For 1995, I estimate that more than 10% of crop in the Three Springs advisory district was no-till sown and more than 50% was direct drilled. In some districts such as the South Morawa/Bowgada area, the proportion of crop established with no-till or direct drilled was more than 60%.

Statewide, membership of WANTFA has also greatly increased and now stands at about 400. This shows that farmers are moving to less tillage systems in a big way. Hand in hand with this move is the increased level of stubble retention. Stubble retention itself has erosion control advantages, but can complicate nitrogen tie up problems with continuous cereals. Changing rotations avoids this problem.

When a legume is included in the system the header row effect is negated. A cereal:legume rotation also helps speed stubble breakdown by providing a source of nitrogen to help soil microbes break down crop residues. For other benefits that farmers perceive see Bill's article above.

There are several obvious examples of how no-tilling improves crop sustainability in my region. These are making the most of the rain that falls, improving soil structural problems, furrow sowing to harvest water on our non-wetting soils and benefits that we get from wider row spacings.

By reducing cultivations before sowing there is an increase in the amount of moisture available for the crop. Water lost with each cultivation is 20-30 mm. This equates to 400-600 kg/ha of grain using a formula refined by Tennant et al., for water-limited crop potential yield. This potential increase in grain is a big boost to the sustainability of our farming systems.

Many hard setting soils can be improved with gypsum and no-tilling. Stubble retention will also allow better water penetration into soils that seal, or are dispersive. By using these systems soil structure greatly improves.

Furrow sowing is inherent in most no-till systems and has some major advantages on non wetting sandy soils and also in lower rainfall areas for harvesting rainfall. It also provides a protected environment for young crops in the bottom of furrow which may assist during early growth. Insects also like this environment and are causing more damage to crops that are furrow sown.

Wider rows are generally being adopted to allow sowing with tines into heavy stubbles. This reduces stubble blockage problems with seeders. However, there are likely to be overall crop yield reductions from wider rows. Despite this, most growers seem happy to go to slightly wider rows of 230-250 mm (9-10") with some yield loss, but stubble handling benefits. Many legume crops do not seem to suffer yield reductions from wider rows. This is a major advantage when handling stubbles in rotations. Cutting stubble short also improves flow through tined machinery.

Our farming systems have come a long way from continuous cereal cropping after clearing, and the many degradation hazards that were inherent in this system. We are now much more aware of land degradation problems and how to prevent them. We are also more aware of the production potential of farms and we are constantly seeking ways to get closer to that potential.

No-till crop establishment reduces degradation and improves the productivity of farming land in this northern region. We clearly need to set priorities that will give direction to no-till research in this state so that both of these benefits can be attained.

Farmer's Section

ADOPTING NO TILL - OUR STORY

Paul Maisey, Dowerin (096 311152 p/l)

We are rapidly changing from multiple to no-till crop establishment systems. Five years ago we sowed with multiple tillage. Four years ago we began direct drilling and this year we experimented with no-tillage.

The evidence of long term benefits from decreasing tillage on our soil types has been clear for many years. My business however, resisted direct drilling due to convenience and logistics. The seeder was still properly functional and direct drilling airseeder machinery was limited. Scarifiers had good tine breakout, but poor trash flow. Chisel plows had high breakout and good trash flow, but the row spacings might be too wide. Also, the chisel plow had developed the stigma of being a passing fad.

At that time I was studying Agricultural Science and my parents were reluctant to change seeding techniques while I was away, as I may return and want to change systems. They decided to wait and include me in the decision making and only have to change once.

Our main reason for resisting direct drilling was poor seeding depth control. Seeding into soft soil made depth control easy. Anecdotal evidence was that direct drilled crops were sown either, too shallow, as the machine skated over the top, or too deep, when the tines dug in. This was my parents biggest fear of direct drilling.

We saw an advertisement, the size of a postage stamp, describing a floating boot for seed placement with direct drilling. Manufactured by Inland Sales and Service of Merredin, the idea was simple, cost effective and easy to fit. So we sold the cultivator and replaced it with a new five row bar with good tine breakout and direct drilled with better depth control with the floating boots.

Our first year of direct drilling gave some curious results. Soil types that I thought would respond to direct drilling gave no response, while soil types I felt would do poorly with direct drilling gave good results. Interestingly, in all cases pastures in following years were clearly better than ever before.

A paddock that gave a mediocre response to direct drilling in the first crop year produced dramatic responses in the pasture phase. The next time that the crop was established using direct drilling there was the large response as I first expected. It would seem that some soil types respond to less tillage faster than others.

With no-till we knew we would need to control in-crop weeds with herbicides. Our herbicide resistance tests showed we were headed for a problem. Because multiple tillage was not killing the weeds, while the knockdown herbicides were, we changed our rotation to 2:1 (pasture:cereal) with 2 years of pasture topping and rotating chemical groups.

At almost every no-till seminar the use of herbicides is typically the first question new comers ask. Many critics have said this is a weakness of no-till. However, our experiences with multiple tillage, like other no-tillers, is that post emergent herbicides are usually needed as tillage promotes weed germination. We also found that tillage for weed control was just wasting time, and this made us more determined to use herbicides efficiently.

Changing from multiple tillage to direct drilling had no impact on herbicide costs and I doubt that changing to no-till will increase it much either. However, changing to direct drill did increase our insecticide use. The tillage fallow removed most insects. However, this came at a cost, particularly with delayed sowing and soil structure decline.

Our direct drilling does have some problems. Seeding depth is not good enough. Even with the floating boot our seed placement is inconsistent. The paddock is left with too many ridges and is rough, which is no better after using finger harrows. These ridges have however taught us that water can be harvested. Rotary harrows probably would reduce the ridges but would damage soil structure.

This year we trialled no-till with the Harrington Agmaster points, which we fitted to our existing tines without needing any other modification. This is a cheap way of 'putting our toes in the water' and we can easily revert back to direct drilling if we thing we need to.

At this stage, both techniques appear equal. The no-tilled crop had a more uniform emergence with a better plant density. Less weeds germinated under no-tilling compared to direct drilling. However, they still needed controlling. The paddocks are much smoother but left enough of a channel for water harvesting. The knife point also gives better trash flow.

Next year we will probably plant our entire crop with knife points. The benefits of not needing to stop and change points, better depth control and smoother paddocks alone, have real appeal.

No-tillage is an efficient crop establishment system which reduces many, but not all, landcare problems. It will not, on its own, prevent subsoil acidity, remove sodicity nor halt rising water tables. These will require other management techniques. No-till will not completely stop soil erosion either. We considered that the benefits of direct drilling would take 10 years to become fully apparent. No-till benefits may also take time to occur. These benefits are always going to be several years from when you start reducing tillage.

We have now just finished harvest, and found that no-till yielded the same as direct drilled crops. We have noticed that there was a bit more variability in yield from the no-tilled crops with differing soil fertility. This could be a useful tool for understanding and meeting specific soil fertility requirements across paddocks.

AGRICULTURE WA, FARMERS AND LOCAL RURAL RESEARCH

Graeme Malcolm, Vice President, Morawa (099 715035)

It is not surprising to find that many policy makers and city based researchers have minimal involvement with the farmers and communities affected by their research. Some of us have had considerable debate over the extent to which farmers are involved in deciding on where industry research funds should be spent.

WANTFA has been in the forefront in wanting to be involved and these statewide three regional meetings on crop establishment have been spawned from farmers' needs to change direction to a more cost effective and sustainable agricultural lifestyle.

Statements like "what would farmers know about research" or "we researched that ten years ago" have only served to widen the gap that exists between research and its implementation on a broad scale. In the new Agriculture Western Australia's climate of research, farmers are expected to be involved in research that effects them. Today we are not only expected to have a say in what issues are examined, it is assumed that we will form an integral part of the research process.

What can farmers contribute? Because we are operating the farming system we have considerable insights into how

that system works. These insights may also provide a better understanding than we can ever build in model form using information derived only from scientific investigation.

By using that insight and experience, research problems should be better specified, relationships better identified and results should pass the common-sense test. This better understanding and the contributions of farmers will ensure the research is relevant and avoid delays in adoption.

In the new Agriculture Agency we hope farmers are included in all farm-related research as a matter of principle. WANTFA's work with no-till aims to use that principle to achieve excellent outcomes.

WANTFA, local farmers and Landcare groups have been essential in defining how the farm system operates, identifying a range of no-till management strategies to be evaluated, and appraising the results. We need our scientists and researchers to test our current knowledge to the limit, but it invariably takes a creative farmer to extend that limit beyond our current horizon.

Address to September Landcare Conference:

There are huge landcare benefits from no-till farming that we have perceived in some northern regions. I will put these in three main categories of more effective rainfall use, better soil structural factors and better overall farm productivity.

Using water effectively is critical to dryland farming, especially in the lower rainfall and warmer environments. With no-till we get less surface water run-off with more water stored in the furrow and this directs more rainfall to the sub-surface down the slots. The crops are more able to use this moisture that is stored in the root zone. We have less waterlogging with our no-till contour sowing which allows less water to get to the lower areas of the paddocks. Also our frequent light opening rains are funnelled to the seed zone thereby, multiplying water in the seed zone.

There are several soil benefits from no-tilling which become obvious. Trash and undisturbed root systems improve soil structure, stop erosion, increase infiltration, support micro-organisms and convert to nutrients through the season.

Continuous cover of trash has many benefits. Surface trash has the effect of moderating soil temperature, being warmer in winter and cooler summer. The trash decreases rain drop splash and also provides more carbon and nitrate for the soil. The trash or stubble protects the topsoil from wind erosion which stops nutrient loss and crop damage from blowing sand. Trash also reduces raindrop splash, thereby reducing leaf disease created by soil fungi and less rain splash stops dispersive soils being separated.

Trash in itself is a store of soil nutrient and particularly nitrates are made available to crops. Their release is slower throughout the season whereas cultivation releases nitrates bound up in the soil. No-tillage provides a slower release nitrogen, thus more nitrogen is available at the end of the season to fill grain and protein. The slow release organic forms make these nitrates and phosphates less prone to leaching into the watertable.

The less tractor power required with knife points thereby reduces traction required, less wheel slip occurs and therefore you can use a lighter tractor. A lighter tractor means less soil compaction and the number of passes over the soil is reduced also.

No-till keeps weed seeds on the surface. Since they are not buried deep they germinate quickly as the seeds stay in a favourable germinating zone and germinate with the first rains. Deep buried weed seeds may take several years to deplete. Pasture regenerates better as the seeds are close to the surface. Pasture seeds also germinate early because of furrowing effect and shallow depth which promotes early germination.

No-till is economically more productive due to better water use, less costs, better whole farm time of sowing, better yields and grain quality. Better rainfall conversion to grain (kg/mm of rain). Whereas cultivation dries the soil by 25-30 mm each time, contour no-till can replace expensive earthworks as no-till on the contours has eliminated our run-off, dams now need to have roaded catchments but we have no further need for large banks.

The less costs include less capital, less equipment, less labour, less fuel, less wear and less maintenance. One machine can cover a large program because of one pass sowing. Labour needs are reduced for all year around and there is less equipment to prepare, fix and replace. Lower hours enables machinery life to be extended.

Less establishment time means a better whole farm time of sowing. Better timeliness of sowing enables earlier sowing into moister soil, and we now expect higher yields and more profit. Our wheat protein has increased by about 1 percent with no-till. Rotational cropping reduces disease and weed carryover enabling weeds to be controlled the previous year, and earlier sowing. The slower and later nitrogen release enables better head filling and protein increase late in the season.

Lower-cost chemicals can be used after buried seed has been exhausted. Long term no-till is showing that chemical requirements are reduced to non exotic types (glyphosate, simazine, diuron or 2,4-D) after the deep seed bank is exhausted.

We now have more leisure time - or time to promote no-till! We must keep our soils where they are, and no-till is so good at reducing erosion and being profitable that we owe it to each other to share this story. No-till and Landcare are inseparable in my view. This year 12 of my neighbours have embraced no-till and we are excited at what it has done for our district.

Quality no-till is never an accident. It is always the result of high intention, sincere effort, intelligent direction and skilful execution. It represents the wise choice of many alternatives.

NO-TILL ON THE SOUTH COAST

Jim Baily, Wellstead (098 471036 fax 12)

During the development years and into the early 1970s, many older paddocks were suffering from serious wind erosion during a cropping phase. Some of this was due to overworking, the necessity at the time to root rate, a general lack of understanding on how to handle our fragile soils, as well as not having the available technology. However, with the advent of Sprayseed during the 1970s, the potential for overcoming these problems started to be realised. There was experimentation being carried out with the Bettison triple disc drill, with limited success.

At this time, a number of farmers started to use existing combines or sometimes a scarifier ahead of the combine, reducing the number of passes with the use of Sprayseed. This became known as Min-till. With the introduction of glyphosate in the early 1980s, the scene was set for change. It was a more suitable and more reliable knockdown chemical.

Around this time a number of farmers felt that Min-till was still disturbing the soil too much, as there was still a number of occasions of minor wind erosion. Hence a number of farmers began experimenting with narrow points to lessen soil disturbance. Ken and Fred de Grussa from Esperance, and Ray and David Harrington at Darkan experimented with narrow points in the 1980s.

During this period, our knowledge and use of sprays had improved and farmers were becoming confident in their use. This led to confidence in being able to seed in a one-pass operation with minimal soil disturbance. Also, management of the crop areas in the season prior to crop establishment was being introduced, like grass-free pastures and spray topping. As a consequence, we were finding our yields were increasing.

In 1991, Tom Atterby from Fitzgerald, imported a Great Plains Seeder for demonstration purposes. This machine was hired out to farmers from Ravensthorpe to South Stirlings with great success. I believe, it was from this point that we started to see the benefits of no-till on a broad-acre basis, resulting in rapid adoption of no-till on the south coast since.

By the 1995 cropping season, we have seen a rapid influx of manufacturers and importers of no-till machines and the choice has now become very difficult for farmers, of what to choose.

While we have tried numerous reduced tillage techniques and have no-tilled with both knife and disc machines we realise that we still have a lot to learn. However, there are some sure things we have learned, particularly with weed control. It

essential to control seed set the year prior to cropping and autumn weeds also need to be controlled in autumn.

We currently use a double knockdown strategy. At 7-10 days after the break, we spray with 500 mL/ha of glyphosate and if the weeds are thick we then use Sprayseed 5-6 days later to ensure a good weed kill. We have learnt that this is needed to ensure that the weeds do die. We do not have a cultivation to finish the weeds off but rely on knockdowns for a complete kill.

We often use 500 mL/ha of Sprayseed in-crop as the cereal is reaching the one leaf stage, in order to control an early weed germination. This gives a tremendous kill and has greatly reduced the more expensive post-emergent sprays. This system works particularly well with disced seeders where there is minimal soil disturbance, but is also effective with knife points.

Generally our no-tilled crops are not as vigorous early in the season, because the nitrate nitrogen is not readily released under no-till. However, by harvest time the yield is comparable with conventional.

We are finding many more soil organisms under no-till, with earthworms being in much greater numbers than before. If that is an indication of soil health, then there must be a micro-biological soil advantage.

Other no-till advantages are numerous, including earlier crop establishment, greater moisture infiltration by not cultivating, much lower moisture loss in dry seasons, our soil is more trafficable in wet seasons, more efficient weed control with herbicides, lower fuel consumption, lower machinery capital investment, quicker recovery of pasture after a cereal crop and yields are maintained and at times increased.

The disadvantages of no-till include; a greater reliance on chemicals for weed control, problems with individual designs of machines, possible build-up of chemicals in the system (however, so far trials show this is not a problem in our environment) and with disced machines it appears that rhizoctonia is not reduced as effectively as with tined machines.

Possibly, the best indicator in recent years of the impact of no-till on the environment was demonstrated this year with the high intensity wind events. On the no-tillers properties, there was minimal wind erosion and, in fact, sheep probably created our greatest wind erosion hazard.

STARTING NO-TILL IN THE FAR NORTH

Bob Porter, Murchison River (099 361021 p/f)

We farm at North Ajana, 110 km north of Geraldton in a 310 mm annual rainfall area. We have been direct drilling wheat for at least 40 years, and lupins for about 20 years, and never once have we got it completely right. I thought seriously about changing our tillage systems about three years ago and I bought the Kondinin Group's "Seeding Edge" and later joined WANTFA, and have gleaned inspiring information from both sources. I wanted to sow at optimum depth with press wheels for covering and regulating depth.

I decided in 1994 to set up a machine for no-till for 1995 seeding. We had a Morris 48 tine chisel plow with 300 mm spacings. I mounted press wheel arms on 26 tines, with another 22 arms on the frame, behind the tines, due to poor clearance for jumping. The arms are edge-on flat bar, hinged at the front with a spring for 100 mm of sideways movement. The press wheels, arms, mounts etc. cost about $100 per row, including their manufacture by NUFAB at Dongara.

We used 50 mm wide pick points, which we had in stock, which made big furrows for water harvesting on dry sown lupins. The fertiliser was put down behind the tine, and the seed tubes mounted back on the press wheel arms. It appeared we now had a machine that would cultivate deep and band fertiliser, furrow sow, sow shallow and have the advantage of press wheels if indeed there were any.

The sowing tubes can be moved up or back, and I was going to drag the point of the 25 mm metal sowing tube in the furrow. But after testing at 10-12 kph on the back of the machine, I decided to just drop the seed in the furrows, as it was covering anyway, be it a bit shallow.

Because the lupins were precisely placed in the bottom of the furrows, we knew that a few mm of rain would bring them up. We had no subsoil moisture, and some of the paddocks we were "setting up" for next years wheat were a bit heavy for Merrit lupins. We had 12 mm of rain at the end of April, and up came the lupins, many of which died from moisture stress over the next 3-4 weeks, when little rain fell.

We applied 2 L/ha of Simazine pre-plant. The 50 mm wide points pushed the Simazine out of the furrows and into the "hills" at the side. Good weed control was achieved with no Simazine damage seen. Also there was no sign of root rot, which is a problem here when shallow sowing with discs. However, the lupins sown with no-till are a bit of a mixed bag due to early drought stress.

We sowed Amery wheat on 12 May on a part of the farm which had some early rain, and there was enough moisture for germination. It was sprayed early in April for summer sprouted weeds with 600 mL/ha of glyphosate. The 12 mm of rain brought up more weeds in early May so we sprayed again with 700 mL/ha of glyphosate pre-plant. I did not want a failure due to weeds on my first real attempt at no-till, especially as I was being watched closely.

We had to seed slowly (8 kph max) as the damp soil was being thrown into the next furrow and filling it. Also we were throwing sand onto the neighbouring press wheels at speed, and cutting out their bearings.

We banded 100 kg/ha of Canola One fertiliser about 100 mm deep, which had a similar N content as DAP, but with a little less P. Because of the deeper furrows the seed was probably only placed 50-75 mm above the fertiliser.

Conditions were warm, and the wheat shoots were showing through in four days, and some had two leaves within ten days. The roots were down 50 mm and close to the banded fertiliser before the shoots were out of the ground. I have never noticed a crop jump away so quickly, and I feel that the shallow sowing and press wheels helped, combined with good moisture and warm weather.

We sowed about 1,000 ha of wheat with this no-till machine, and it all looks OK. Some looks very good by our standards. However, I am not happy with the furrows. They are too deep and the ridges too high. So after seeding, we fitted DBS points, which are only about 12 mm wide on the blade. After testing, I think we will do a better job next year and should be able to cultivate a bit deeper, and have smaller and more even furrows.

We have now finished harvesting our whole program and have some positive and mixed feelings. Our crops did not blow, for which we are pleased. One paddock on some weaker soils, from which we have never had a good yield, went really well. With 2.0 t/ha of Amery, which is 30% better, than it has ever done before with other wheat varieties.

I think there is an interaction between varieties and row spacing. Although not tested with a trial, I feel that Wilgoyne does not tiller as well as Amery. Therefore Wilgoyne may not be a good wheat to sow with wider rows. Our worst no-till yield was 1.2 t/ha of Wilgoyne. Our whole program was sown at 300 mm row spacings, and Amery consistantly yielded 15% better than Wilgoyne.

There is a crude over-the-fence comparison which may tell us more about Wilgoyne and row spacings, although there are other differences as well. My neighbour sowed with a two-way offset disc plow on 200-220 mm row spacings. The paddocks had similar history of rotation, legume content, fertiliser and soil type. His Wilgoyne went 10-15% more than mine. The difference appearing greater on the sandier soils. This issue needs looking into.

Deep banding seemed to have a negative effect on grain yield. A 300 m long trial showed that deep banding yielded 8% less than where I topdressed the fertiliser (1.53 versus 1.63 t/ha). Interestingly, drilled fertiliser yielded similarly less (11%) than topdressed fertiliser. I will be more cautious about deep banding in the future.

Editor here! If you have any row spacing experiences, either good or bad for wide rows, then please send them in and we will publish them in the next issue. John Ryan (from Ausplow DBS) said he would contribute an article. Also I would like to hear of swathing and deep banding experiences with different row spacings. Please fax me on 090 761227. Thanks, Bill Crabtree.