TO MEMBERS

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Western Australian No Tillage Farmers Association (Inc) WANTFA

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Topical Section

500 ATTEND MORAWA MEETING

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

An attendance of over 500 rewarded the Koolanooka Bowgada Landcare Groups efforts in organising the No-Till Seminar and Field Day at Morawa on August 2-3. Chairman (and WANTFA Vice President) Graeme Malcolm reports that 500 attended either the Seminar or field day. The 450 at the Field Day was a sight to see. It included two bus-loads of farmers from north of Geraldton.

The meeting heard of experiences in adopting no-till from farmers Tim Pannell at Yuna, Bevan Olden of Morawa, Tim Officer of Coorow and Tony White of Miling (the later 3 published in this edition). Canadian engineer Ben Dyck described two decades of research and development of no-till seeders in Canada. Ben also did spoke at 10 regional meetings throughout the agricultural areas (WANTFA is grateful to GRDC and the Soil and Land Conservation Council (WA) for financial support for Ben's visit).

The Chief Executive Officer of the Department of Agriculture, Dr Graeme Robertson addressed the meeting, along with several other Department speakers and farm service company representatives. Research Officer Paul Blackwell and David Messina of SBS-IAMA showed visitors over their detailed no-till trials on the field day, as well as providing entertaining talks at the Seminar.

After viewing the no-till trials, each of the seeders were shown at the Field Day. Four no-tilled farmers paddocks and seeders were then visited after a lunch stop. The two days clearly demonstrated the current widespread interest in no-till, supported by an average attendance of 40 at Ben Dyck's ten regional meetings on no-till seeders in Canada, and other large, no-till field day attendances throughout the state.

Five years ago, a mere handful of farmers sowed without tillage. With perhaps 10 % of farmers using no-till systems in 1995 - and 35 % in South Coastal areas, as estimated by Dr Robertson at Morawa - I can do no better than repeat WANTFA Committee member John Hicks comment of three years ago, that no-till is an idea whose time has come! And soil can be conserved in good condition for future generations, while increasing profit, by learning and applying this conservation cropping system.

PRESIDENTS NEWS

Ken de Grussa, Esperance (090 782026 or fax 07)

It is probably not too evident to members generally, but the WANTFA committee has been quite busy since seeding finished. Some of the recent events have been alluded to in Kevin's article above. Including the visit of Canadian engineer Ben Dyck in the second half of July and hopefully you will have benefited from attending one of eleven meetings with Ben. Kevin has effectually covered the highly successful No-Till Seminar and Field Day at Morawa but I would like to take this opportunity to express my appreciation to Graeme Malcolm and his hard working crew for the considerable effort put into organising that event.

In the past month we have been engaged in discussions with the Department of Agriculture to finalise details for the three workshops on crop establishment systems, essentially No-Till, which were held in the three agricultural regions. The workshops were held as a result of the support and interest in No-Till by the Minister for Primary Industry, Monty House, and the first at Jerramungup on 8 September was officially opened by him. This workshop was well attended, and while the other two at Three Springs on 20 September and Kellerberrin on 22 September were somewhat smaller. I'm sure the input from the farmers who attended was effective. We hope to see a worthwhile outcome from the workshops in the near future.

Some of our members who visited North America last year were impressed by the knowledge and experience in rotational cropping of Dwayne Beck. Dwayne is the Director of Dakota Lakes Research Station, Pierre, South Dakota, a grower funded centre run by the South Dakota State University. Dwayne's special interest is cropping rotations for disease and weed management, soil fertility enhancement and improved soil water use in No-Till systems. We plan to have Dwayne visit this State in February 1996, and the Minister, Monty House has generously donated $2,500 towards the cost of bringing Dwayne over. A number of regional meetings will be arranged and it is hoped that Dwayne will also attend our AGM.

INTRODUCTORY COURSES ON GETTING MANAGEMENT RIGHT

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

We depend on specialist information to improve the cash aspect of our farm systems. But it is the farmer who has to put it all together, managing for the whole farm and the people on it.

(W)holistic management optimises profit, quality of life and the environment you leave behind. A Holistic Resource Management system has been worked out over the last thirty years in Africa, America and, now, Australia. Introductory courses were offered at Perth, Morawa and Boyup Brook on 6, 7 and 9 October respectively.

Four years ago I had the pleasure of a Wesfarmers Churchill Fellowship trip investigating no-tillage in America. The first farm I was taken to was George and Elaine Work's in Central California, who practice Holistic Resource Management. George has won several US national awards for his management excellence.

George and Elaine invited us back on WANTFA's No-Tillage Study Tour in North America last year. The Koolanooka-Bowgada Landcare Group at Morawa then raised funds to get them over to give talks when they were on a trip to the Wimmera Conservation Farming Association in Victoria last March. Bruce Ward of Moree, New South Wales, has trained in Holistic Resource Management in America, and has been conducting courses in Australia for over a year now.

Holistic Resource Management starts with each enterprise determining a three-part goal. The first part identifies the Quality of Life values which the people who manage the business desire. Secondly, they identify the Forms of Production which are necessary to achieve these values. Unless this step is completed the values are merely words on paper. 'Forms of Production' are required to make the values realisable. Thirdly the people describe how the land must look - the 'Future Landscape' - if it is to continue for all time, improving and providing the values the people require.

Bruce Ward, and his wife Suzie, own the agricultural consultancy, Moree District Business Centre. The Centre's purpose is to train practitioners in Holistic Resource Management. Immediately following the one-day overviews, Bruce conducted the first three days of his nine day full course in Holistic Resource Management on 11-13 October in Perth arranged by former WANTFA Committee member Ian Edwards, who organised the WANTFA formation meeting at Beverley in 1992. This training covers the decision making process, land planning, soil and plant monitoring, grazing planning and an easy to comprehend financial planning and monitoring process.

After following up Holistic Resource Management in America last year, I believe it can allow us to optimise whole-farm systems using no-till. I will keep you posted through the WANTFA Newsletter on developments in Holistic Resource Management in WA (Enquiries: Suzie Ward or Lennie Chaplain, Phone (067) 52 4100, Fax (067) 52 5010).

THEY NO-TILLED IN "THE LONELY YEARS"

Kevin Bligh WANTFA Secretary, Perth (09 368 3893)

No-tillage sowing appears to be entering the mainstream, with perhaps 10% of Western Australian grain-growers sowing without tillage in 1995. In America it is suggested that no-tillage is the fastest technological change to have occurred in agriculture- faster than tractors came in, for example - and adoption rates in the US are slower than ours!

Before they're forgotten, I would like to remember the early developers who plugged on and worked with no-tillage through the "lonely years" from the mid 1970's, up to the formation of WANTFA in 1992, and to honour those who suffered costly mistakes. It is possible that I have inadvertently missed someone out; if so, my apologies! My potted history of the people involved includes:

David Kettle (formerly of Esperance), used and imported Bettinson triple-disc drills from 1975. Esperance farmers such as Tony Overheu, John Luberda and Athol and Bob Hockey have used their Bettinsons in most seasons, since.

Mike Brown of Narrogin has used the second Bettinson imported into Western Australia for the last twenty years, currently pulling two in tandem. Mike considers his move from multiple tillage to direct drilling from the late 1960's, far more difficult than his subsequent move to no-till sowing.

Richard Barker and Ray Honey of McAlinden (south of Collie) also used Bettinson's from the late 1970's. Richard's farm was resumed by the Water Authority for reforestation in the Wellington catchment in the mid 1980's, but his neighbour, former WANTFA committee member Ray Honey, has no-tilled since.

Rick Hurst of Gairdner (south of Jerramungup) started direct drilling with only sowing tines, fitted with 50 mm wide chisel points in 1982. Rick currently chairs the 25 October 1995 Jerramungup Expo organising committee.

Ken and Fred de Grussa of Esperance took the cultivating tines off, and fitted "Janke" press wheels on their Shearer combine seed drill in 1984, put 12 mm wide lucerne points on in 1987 and front disc coulters in 1990. Ken is the current President of WANTFA.

Ray and David Harrington of Darkan had been making their own low-profile winged points since the early 1980's. They had put a few that had their wings knocked off, on one end of their air seeder, which left only the vertical shank remaining, as a knife. They checked the crop later, and it seemed just as good! Both have no-tilled since. Ray was the Foundation President of WANTFA, from 1991-94.

Lindsay Chappel of Perenjori sowed with chisel points on his Leon air seeder in 1985, fitting narrow points again in 1990.

Ian Edwards of Beverley read of Albert Rovira's and David Roget's work in CSIRO in South Australia on improved soil structure using narrow points, used them himself from 1991, and hosted WANTFA's formation meeting at Beverley in 1992.

Tom Atterby (formerly of Jerramungup) took a prominent part in importing double-disc no-till seeders from 1990. Together with consultant David Rees, Jerramungup farmers obtained funding for 12 Great Plains double-disc openers in 1990, and Tom put them under an old Department of Agriculture plot seeder. He then imported and hired out a Great Plains drill in 1991. (About 40 drill equivalents were sold in 1992 alone.) Tom is now State Manager of Great Plains Manufacturing Inc.

SCIENTISTS AND ENGINEERS also provided technical expertise to enable the development of No-Till sowing in Western Australia, notably:

John Baker and **Bill Ritchie** (formerly of Massey University, New Zealand). John's name lives on from the mid-70's in the Baker Boot ("inverted T" - shaped point). He then developed the Cross-Slot disced seeder, visiting Western Australia and addressing farmers' meetings at the invitation of Chris Gilmour and Bill Jensen of Wellstead in 1991. His colleague, Bill Ritchie visited WA promoting the Cross-Slot in 1986, and again in 1992, on consultancy to the Wellstead Research Group. The two continue to work together in the newly-formed, Baker No-Tillage Ltd at Fielding, New Zealand, and the Centre for International No-Tillage Research and Engineering (CINTRE).

Bill Johnson (formerly Concept Engineer of Ralph McKay Ltd, Melbourne). Bill worked on developing and "inverted T" - shaped point in grain growing areas from the late 1970's, and, later, supplying a 50 mm wide deeper-bladed versions to farmers, CSIRO in South Australia, and the Department of Agriculture in Western Australia.

Albert Rovira (retired) and **David Roget** of CSIRO, Adelaide, worked on narrow points during the 1980's, showing as little rhizoctonia hazard with no-till as with conventional sowing, provided there is soil disturbance below and around the seed zone. After about eight years, rhizoctonia was suppressed to negligible levels by other soil microorganisms, particularly under direct drilling and no-till sowing. David is confident that the effect is enhanced with stubble retention. He was brought over from Adelaide by the Wellstead Research Group in 1993, and was keynote speaker at WANTFA's First Annual Conference at Darkan.

David Rees (Agricultural Consultant, Albany) worked to improve depth control and stubble-handling in the 1980's around Jerramungup, identified the potential of double-disc openers with clients such as Tom Atterby (see above), and has provided scientific input on no-till sowing since.

Bill Crabtree included chisel points in his Department of Agriculture trials at Jerramungup in the mid 1980's, and propagated no-till sowing on the South Coast. Bill has edited the WANTFA Newsletter since 1993.

Kevin Bligh (editor speaking!) investigated rainfall runoff under no-tillage sowing from 1980. In 1983 Kevin became convinced of the huge water erosion benefits no-tillage offers. Kevin has been instrumental in linking no-till farmers together throughout the state and played a vital role in the formation of WANTFA and is the Secretary (end ed).

There were many others who were - and are - prominent in the development of no-tillage sowing in Western Australia. I look forward to reading other people's "potted histories" in the Newsletter - but I would suggest that at least these twenty deserve to be acknowledged for their work in "The Lonely Years".

Excellent people also continue to operate in the farm machinery industry, making no-tillage openers available. Without them, also, far fewer farmers would be sowing without tillage today!

IS NO-TILL SAVING THE PLANET?

Bill Crabtree, Development Officer, Esperance (090 761333)

Well it is, according to Dennis Avery, Director of Global Food Issues, Hudson Institute, Indiana in the USA, who addressed the Manitoba/North Dakota Zero Tillage Farmer's Association Annual meeting on 25 January 1995. In this controversial 16 page address, Dennis develops the idea that 'zero tillage and high-yield farmers are literally the solution to the world's most pressing problem: the apparent conflict between people and wildlife all over the planet.'

He is scathing of those who believe that the world cannot sustain a population of more than 2-3 billion. He suggests that some people fear global overcrowding more than they fear famine for far away people. These people, he suggests, are more inclined to prefer non-chemical and lower-yielding agriculture than a relatively non-erosion, but chemically involved and high yielding zero-till farming. Avery suggests that we will need at least enough food for 10 billion people by the year 2040. The extra food, he argues, would need to come from high yielding and sustainable farming.

Avery continues with some radical statements with supporting references, like: "Farm chemicals do not cause cancer in humans, they prevent cancer. They suppress moulds and toxins in our food which could otherwise trigger cancer" "Pesticide residues are one ten-thoudsanth as dangerous to humans as the naturally chemicals found in our food" "We are still looking for the first victims of DDT. No human death has ever been laid on DDT...." "DDT produced no impact on 'a bird studied' or on their eggs" "In the real world there is no evidence that anyone has ever died from pesticide residues - or had their endocrine system damaged".

Avery appears to be concerned that we might lose high-yield farming to a myth, the myth being that fertilisers and pesticides are all bad. He says "environmental zealots (often without science) are moving so effectively, and with so little opposition, that they may well make organic farming the only politically correct way to produce food in affluent countries." "It is more and more public perception which governs". The starving millions in other countries can be given a lower priority compared to the concern of pesticide use.

High farm price supports in the US and other countries also get a serve. Avery suggests that there are many soil types that can not grow crops sustainably. The artificial financial impacts have enticed farmers to farm unsuitable soils or environments. Over-intensified fertiliser and herbicide use in Europe and chemicals in Asia for rice have done no-one any long term favour.

The story gathers real momentum towards the end. You can't help but ask yourself lots of searching questions as you read his compelling writing. He finishes by saying that "High-yield agriculture must forget its defensive posture and launch an environmental counter-attack. We must help the public understand the real issues at stake here....." To find out more I would suggest you ask me for a copy of his talk, or Ken de Grussa, or contact the Manitoba/North Dakota Zero Tillage Farmer's Association. I believe he has published also. What a read!

(Topical Section continued overleaf.)

WHICH NO-TILL MACHINE SHOULD YOU BUY?

Bill Crabtree, Development Officer, Esperance (090 761333)

Given our State's good potential grain harvest, many farmers are likely to purchase new seeding equipment and possibly tractors as well, depending on which seeder system to purchase. Which seeding machine is most likely to suit you?

What are the main fors and againsts for the three main no-till seeding systems, including; disc, narrow (<50 mm wide) point and combination of both. The following table, while not water tight, should be a useful guide to help you decide which system to adopt.

Issue Can the unit:	Disc	Knife point	Disc and knife point
Sow into thick wheat stubble	Will do easily, but pins some stubble	• Not possible on south coast • Apparently will up north with short straw	Often will
Sow through • melons • wireweed	 Yes Yes	 No Yes	 Yes Yes
Reduce rhizoctonia bare patch by	0-30% with 4 cm seeding only = 0% and wavy by ~30%	• 0% for seeding only • 60-80% for deep knife pts • 90-95% for deep ripping	ditto
Be used to sow into tillage-responsive soils	Not good with slow root growth and less N released	If worked deep, 8-12 cm can do as well as full tillage but with less N released	ditto
Sow into heavy soils	Some can but most discs and press wheels will stick	Best technique available and beats full tillage by far for many reasons	Disc component may stick
Horse power?	Low to moderate	Moderate to high	ditto
Sow into water repellent soil	Creates good but often small furrows	Can make furrows of many dimensions	ditto
Stimulate extra weed germination	Will not	Varies and depends, but should be less than full cut	ditto
Incorporate trifluralin	Unlikely	Can be very effectively	Yes
Rip up rocks	Never	Yes, some in a big way!	Yes
Ride over sheet rock	Easily	Some do and some can not	ditto
Induce fertiliser toxicity	Yes with wide rows, liquid an option	Can happen, but has deep-band option	ditto
Increase bean root maggot damage	No, best method	Happens with stubble burial	ditto

On what farms would disc machines most suit:

Where there are rocks that you do not want to rip up, in very high stubble levels, very erosion prone soils, where soils are not tillage responsive, after good legume pastures or crops especially if little grain is exported, when wanting to reduce in-crop weed germination, where rhizoctonia damage is mild and where bean root maggot may occur.

Disc machines recently sold in Western Australia:

Plain double disc, include; Great Plains, Walker (WA made), John Deere and K-Hart. Double disc with leading wavy or fluted coulters, are mostly as above. Scalloped double disc include, Acraplant and Agrowplant. Single angled disc like John Deere Biomax, Forward Germinator and Woolford.

All these machines are now either available as airseeders, or can simply be made into airseeder machines, or disc units can be fitted under combine seeders. Several farmers have done this at low cost.

On what farms would knife points most suit:

Where rhizoctonia is common and severe, where soils are very responsive to cultivation, where a full range of soil types exist, where cheap modifications are desired, where trifluralin is needed and on soils that are prone to fertiliser toxicity (use deep banding). These knife points can penetrate even the toughest of soils, provided tine breakout is at least 80 kg.

Knife points that are commonly available and readily used are:

Primary Sales Super Seeder and Knife points, Harrington Agmaster knife points, Keech points, Ausplow DBS points, Caldow points and Agro-Drill points.

How deep do you need to go with knife points?

This again depends on your soil and environment. It can be unnecessary or damaging to work soils deep (>9 cm) particularly on several soils, where:

1. shallow or sheet rocks exist,
2. sodic soils (sour) are below the topsoil,
3. acid Wodgil soils may or may not benefit—need more work,
4. leaching readily occurs and deep banded nitrogen may be lost and
5. on soils that do not respond to cultivation.

Conversely, there are some soils that greatly benefit from cultivating to 10 cm depth or more. These include:

1. soils that are responsive to cultivation—like Wongan Hills loamy sand,
2. land that is partially saline - allowing the salt to leach and
3. where a chemical or physical hardpan exists—plants with horizontal taproots at 8-10 cm depth.

Product availability, service and back-up support:

Some companies are very efficient at supplying what you need and when. Sadly others do not have such a good reputation. Ask around and do not get caught out, as several have done this year. Make deadlines, with time to spare, and follow them up. The early bird will catch the worm.

Beware of spurious claims. There is always an element of 'panacea thinking' that goes on with new techniques or technology. Be cautious with claims like "No-Till will solve all your problems", 'cos it won't! One 'you-beaut' machine will never grow you a crop. The whole agronomic package is needed. Remember salesmanship applies to No-Till gear also.

So which one for you?

Do not jump in too quick with the most expensive machine. Do some homework! The most common response from farmers who have been on No-Till field days is "now I'm so confused". It appears to me that this confusion is an important part of decision making, and is a part of the process of looking at all the options. So be encouraged if you have been confused, as this could save you making costly mistakes.

When people buy something that is expensive there is a temptation for them to justify an expensive purchase with all sorts of logic. So listen discerningly! On the other hand, some of the expensive No-Till machines bought over the last 4-5 years have well and truly paid for themselves. It will also suit some farmers to purchase a machine that is up and running.

It is likely that a combination of machines will suit many farmers. Both disc and tine machines and combinations have clear advantages in different environments. The above table is not above reproach and is only my view (at present) of some of the issues involved in No-Till type of equipment. All the best.

Science Section

The following two articles have been taken from the Proceedings of the Stubble Retention Workshop which was held at Geraldton on 6-8 August 1991. The articles are an encouragement to those who are planning to retain stubble. However, there are some disease difficulties that need to be avoided, particularly in some environments and rotations. To get a copy of the Proceedings contact Jenny Garlinge, of the Department of Agriculture's Division of Plant Industries in South Perth (09 368 3333) and ask for Technical Report No. 41, December 1991.

INTRODUCTION

Mike Perry and Greg Hamilton, Perth (09 368 3276)

Stubble production is the largest agricultural industry in WA. Each year we cultivate, fertilise, spray and harvest approximately 12 million tonnes of crop stubbles. Unfortunately in the past we have regarded that stubble as an unwanted by-product - 'Stubble Trouble' and 'stubble management with a matchbox' has perhaps exemplified our attitude to crop stubbles, and it still does for too many farmers. On the other hand, some present will view stubble as an essential part of their cropping system - something which *makes it possible to crop.* This divergence of attitude and practice is one reason for holding the workshop.

Probably nobody would question the desirability of retaining crop stubbles *per se.* Indeed, our assumption in organising the workshop was to solve problems in the retention of stubbles in our farming systems. Whole farm economic models have helped to focus on the monetary value of stubbles on mixed farms. What we have not yet done is to incorporate environmental values into the equation. Elsewhere in the world this is being forced on the farming community. In Britain stubble burning is banned, and in some North American States stubble retention and reduced tillage practices are being enforced by local laws.

The history of this workshop goes back to 1987 when the Wheat Industry Research Committee of Western Australia and the Research Committee of the Western Australian Farmers' Federation held a Workshop entitled "Soil Management for Sustainable Agriculture". The 1987 workshop was a response to growing concern over environmental degradation in general, and its aim:

'examine soil research undertaken to date... with a view to the management of the soil resource for profitable, sustainable grain production, and to suggest some models for the integration of such research'. The results of the workshop were published by Robertson (1989) and included a list of 45 priority topics for research.

The Western Australian Farmers' Federation Research Committee subsequently invited Dr John Loveday, a noted soil scientist, to review and comment on the priority list of research topics and to recommend strategies for research to meet the more important priorities. One of the more important priority topics was stubble management. To quote Loveday's report (Loveday, 1989) -

There appears to be a need for more sharply focussed activities in relation to stubble management, perhaps initially with a workshop and the appointment of a co-ordinator, whose tasks could include reviewing the topic to highlight the interactions and instigating integrated research to meet perceived problems and ensure adoption. For agriculture to be sustainable under cropping the soil must be protected against erosion for which retention and management of stubble is essential.

This Stubble Management Workshop is the fruition of Loveday's recommendation. It has again been made possible by funding from the State and Commonwealth Wheat Committees of the new Grains Research and Development Corporation (GRDC) We have with us three members of the newly formed National Committees of the Grains Research and Development Corporation, Mr Wayne Obst and Dr David Morrison (members of the Farming Systems Committee) and Mr Rodney Field (member of the Plant Production Committee). A second WA member of that committee is Dr Clive Francis. The report of this Workshop will go back to the GRDC where we hope that it will contribute to the determination of research and extension priorities for the Corporation.

Our aims for the workshop are therefore to:—

i) review what is known about stubble, both in general and in relation to research conducted in Western Australia; and

ii) identify research, extension and machinery needs to overcome barriers to the adoption of stubble retention farming practices.

We are here not just to learn more about stubble handling for our own farm or our own extension program - we're here to plan for the future. The land development ethic of the decades of the 1950s and 1960s, when scrub was there to be chained and burned, have long gone. The imperative now is for sustainable and productive farming systems that do not degrade the air, water or land of the State; and as John Loveday said, for agriculture to be sustainable under cropping, retention and management of stubble is essential. Each of you here today was invited because you have something to contribute. We want your views on what needs further research and in particular, what is holding up the wider adoption of stubble management (not burning) systems in the farming community.

To obtain your views we have organised small group discussions of research and extension needs and a voting process to arrive at decisions about which are the most important. The priorities identified by the groups are to be fed back for general discussion and then to be voted on during the final session of the workshop. What we decide is likely to be quite influential in deciding future research and extension funding and we urge you to participate constructively in the discussion and voting process.

INFLUENCE OF STUBBLE ON SOILS

Judy Tisdall, Dept of Ag, Tatura, Victoria (058 335222)

The yields of cereals have not increased greatly in Australia over the past 30 years (Editors note, yields have increased in WA since this article was written in 1991) and are still only about half the potential determined by rainfall. The low yields are in part due to climate. However, low yields are also due to our fragile soils and have been worsened by our traditional systems of tillage and burning of stubbles. These systems reduce the levels of organic matter and biological activity in soil, whereas the growth of pasture increases them.

Organic matter in soil includes all living plants, animals and microorganisms and the organic materials that they release. Organic matter in soil also includes all the residues of plants and organisms at various stages of decomposition down to humic materials. The organic matter holds the soil together against erosive forces, keeps the soil soft, permeable and well aerated, and supplies food for roots, microorganisms and animals in the soil.

In this paper I will discuss:

a) the stabilisation of soils by roots and microorganisms,
b) the effect of organic matter on soil animals, and their effects on soil structure and
c) the supply of nutrients by organic matter.

Stabilisation of Soil Aggregates

The topsoil of red-brown earths contain high levels of fine sand and silt and low levels of organic matter. Traditional systems of tillage and the burning of stubble destroy organic matter, making the soils unstable. Unstable soils slake or collapse when wetted quickly by rain or irrigation and set hard and dense when dry. The hard dense soil restricts the growth of roots and hence yields. When slaking is sever, a crust forms on the unprotected surface and restricts infiltration and emergence of seedlings.

On sloping land water runs off unstable soil, carrying with it the most fertile part of the soil and reducing the potential length of the growing season. On flat land the slaked soil is easily waterlogged. Either way, water is wasted, reducing the effective growing season and yields. In sandy soil, a system of tillage with burnt stubble destroys the organic matter which once held the soil together against erosion by wind and water.

After decomposable organic residues have been added or after the growth of plants, soils usually become more stable to water, that is, aggregates do not collapse when wetted. At Tatura, ryegrass grown in the field for 6 months doubled the stability of aggregates of a red-brown earth. The stability is related to the length of root grown, to the amount of organic material released into the soil and of the microbial population in the soil.

Pastures generally produce more roots and release more organic materials into the soil than do crops, so soils under pasture are more stable than soil under crops. Under ground pastures, the soil is most stable in the top layers where most of the fine roots, organic matter and fungi are found. With time, roots and microorganisms grow into the deeper soil which becomes more stable.

Soil stability increases more quickly under grasses than under legumes. Grasses not only tend to produce more roots than legumes do but also release more organic material into the soil. Since tillage breaks up the root systems, oxidises organic matter and decreases the microbial populations, direct-drilled soils are more stable than tilled soils. Since crops supply more organic matter than a fallow, soil cropped every year is more stable than soil fallowed every second or so years. Perhaps for increased stability, crops with many roots which release much organic material should be included in the rotation of direct-drilled crops.

Roots, root hairs and fungal filaments or hyphae, especially those of vesicular arbuscular mycorrhizal (VAM) fungi, bind microaggregates (< 1/4 mm diameter) or sand grains into stable macroaggregates (> 1/4 mm diameter). Within each stable macroaggregate, many fine roots and fungal hyphae form an extensive network. Each fungal hypha is about 1 um wide with clay sticking to it through a mucilage of gums, keeping the aggregate intact and stable. That is, the soil will not be eroded or set hard, but will remain soft, permeable and well aerated. These fungi which stabilise aggregates can produce up to 50 m of hyphae per gram of soil.

Where organic residues are added to soil, the hyphae of saprophytic fungi (which live on dead organic matter) also hold the aggregates together. The hyphae of these fungi disappear from soil once they have used up all the decomposable residues. On the other hand, VAM hyphae appear to persist for longer and are probably more important stabilisers of soil aggregates.

VAMs are common in most soils and in most species of plant. A mycorrhiza is a relationship between a fungus and a root, where they hyphae grow inside the root and in the soil, and get their carbon from the root. In return they take up phosphorus and other nutrients for the plant. For fungus to stabilise aggregates it must be able to infect and colonise the root, and survive in the soil. Unlike strains of rhizobia which can only infect specific plants, most species of VAM fungi can infect most species of plants. However, as the plant supplies carbon to the fungus some combinations of plant and fungus may produce more hyphae in the soil or more gums than others. Also some species grow further out from the root than others.

We do not know how to encourages VAM fungi to grow and survive in soil, or to stabilise aggregates. The soil pH, organic matter, fungicides, pesticides, other organisms and the level of phosphorus in the plant affect some VAM hyphae in soil. Long fallow and excessive tillage break up the network of roots and hyphae, readily destabilising aggregates, and probably slow the rate at which hyphae can later infect plants and stabilise aggregates.

Roots also affect soils by producing pores or channels. As roots grow through soil, they prefer to follow cracks or old channels formed by roots or animals. However, once in a channel the root can expand and widen the channel, and so increase aeration and the growth of future roots. These channels are often very stable and under direct-drilling may remain from crop to crop, however tillage may destroy them.

Soil Animals

Organic residues from plants, for example stubbles, increase the population of soil animals, some of which mix nutrients with soils, some break down organic matter, and some produce burrows in soil. These animals include microfauna, mesofauna and macrofauna. The most common are the microfauna, which are shorter than 0.1 mm, but are hard to see and are not being studied in Australian soils.

The mesofauna range from 0.1-100 mm long and include small insects, spiders, small millipedes, mites and springtails. Little is known about the microfauna and mesofauna in Australian arable soils, although they are probably very important in the breakdown of organic residues. However, under one wheat site in SA, David Malinda found 47,000 mites and 25,000 springtails per m^2 in a direct-drilled soil and 25,000 mites and 8,000 springtails per m^2 in a traditionally tilled soil.

The macrofauna are longer than 100 mm, are easily seen and include earthworms, large woodlice, large millipedes, centipedes, snails and large insects, ants and termites. Most work on macrofauna in Australian soils has been done in south-eastern Australia on earthworms. However, other macrofauna may be more numerous and more active in some of the soils of the WA cereal belt where food and water are scarce.

Abbott showed that the main macrofauna (termites, ants and beetles) had produced burrows in three virgin soils of the WA cereal belt (annual rainfall 340-450 mm). Tillage had almost eliminated these macrofauna and their burrows from the tilled soils, probably because tillage had destroyed their food and burrows. We understand little of the activities of these animals in soil, although their beneficial effects may be similar to those of earthworms.

In 1980, Abbott and Parker, found four species of earthworms in a total of 122 sites in the WA cereal belt. They found earthworms in 54 % of sites with pasture, 23 % with native vegetation, but in only 18 % of tilled sites. Laboratory experiments suggested that insufficient food rather than low rainfall probably limited earthworms in these soils.

Earthworms can survive on a diet of mineral soil but they lose weight without organic matter of high quality (high N levels). For example, Lee found the lumbricid *Apporectodea caliginosa*, when fed for 40 days on:

a) unamended soil lost 53 % body weight;
b) soil plus *Phalaris* roots or grass lost 26 % body weight;
c) soil plus clover roots lost 2 %; or
d) soil plus sheep dung, gained 71 %.

By providing food, retained stubble increases numbers compared with burnt stubble. For example, in two sites in south-eastern Australia, there were about twice as many earthworms in direct-drilled soil with retained stubble, as in direct-drilled soils with burnt stubble or in traditionally tilled soils (Rovira *et al.* 1987; Haines and Uren, 1990).

Although earthworms can survive in dry soil, they are not active. Prolonged drought can kill them. They are sensitive to poor aeration, and often abandon poorly drained soil temporarily after rain.

Effect of Earthworms on Soil Structure

Earthworms affect soil structure by burrowing through soil, by mixing organic litter into the soil and by producing casts (Lee, 1985). The earthworms also probably affect the soil indirectly by mixing fertilisers and pesticides with soil. Earthworms ingest and mix large amounts of soil and organic matter in their guts and then deposit the material as casts. This effect is obvious in soil stabilised by organic matter and managed under systems of direct-drill.

Many species, especially those which burrow horizontally, ingest food from beneath the soil surface and deposit the casts at the surface. The casts are aggregates of soil, and (especially where there are high levels of organic matter) tend to be more stable than the surrounding soil. That is, the casts do not slump or slake when wetted by rain or irrigation. In the field it is mainly aggregates at the surface that are wetted quickly during irrigation or rainfall, and slake easily if unstable, so stable casts produced continually at the surface by earthworms prevent impermeable crusts from forming.

In the surface layers of European soil, 50-100 % of aggregates may be earthworm casts. Temperate Australian soils (lower amounts of surface litter) are dry throughout sum-

mer, so suitable earthworms produce casts and burrows over winter and spring but are inactive throughout summer. Some species aestivate over summer, by coiling up in a mucus until winter returns.

Earthworms produce their own burrows to live in and to move around soil, as opposed to some animals which live in cavities formed by other animals or roots. Soils where earthworms are very active have an extensive network of interconnected horizontal and vertical burrow, which are usually continuous to the surface. Earthworm burrows are very stable and may persist for years after the earthworms have left. The burrows are 1-10 mm wide depending on the size of the earthworm.

Earthworms increase the macroporosity (% of large pores) of the soil. During the frequent non-ponding rainfall in the Mediterranean climates in southern Australia, these burrows are too big to conduct or retain water and are usually filled with air. Ehlers, showed that roots could use old earthworm burrows or root channels (biopores) and so could penetrate hard soils.

Nutrients

Organic matter regulates the supply of nutrients to plants. This is partly because organic matter contains most of the nutrients needed by plants, and partly because some nutrients become adsorbed by organic matter and are released slowly into the soil. The surfaces of most organic matter in soil are negatively charged, and attract and hold positively charged nutrients.

These positively charged nutrients include ammonium, potassium, calcium, magnesium, iron, manganese, copper and zinc. Some organic surfaces are also positively charged and attract and hold negatively charged nutrients. These negatively charged elements include nitrate, sulphate, phosphate, molybdate, borate and chloride. There are fewer positive than negative sites on the surface of organic matter, so most negatively charged nutrients are easily leached from the soil.

Leaching is particularly important in sandy soils, which have little capacity to adsorb nutrients. Organic matter also forms complexes with micronutrients such as iron, copper, manganese and zinc in soil. These complexes supply such nutrients in forms that are readily available to plants.

Nitrogen

More than 95 % of nitrogen in soil is present in organic matter. Plants cannot use this nitrogen until microorganisms have mineralised it to ammonium or nitrate. Most of the nitrogen mineralised comes from organic matter added to the soil during the previous 1-5 years. The microorganisms release the nitrogen slowly and it is therefore less likely to be leached out of the root zone. However, for high yields, crops often need extra nitrogen from legumes or fertiliser.

When stubble is burnt, nitrogen is lost from the soil as gas, although nitrogen disappears from the soil more slowly than organic carbon. Tillage breaks up soil aggregates, subjecting organic nitrogen to mineralisation into inorganic nitrogen and increasing the risk of nitrate being leached. Hence, soils fallowed every two or more years often contain less nitrogen than soils cropped every year. On the other hand, the growth of legumes increases the level of organic nitrogen in the soil.

DEEP BANDING AND TOXICITY

Mel Mason, Senior Research Officer, Perth (09 368 3538) and Caroline Peek, Development Officer, Geraldton

A recent case of poor wheat emergence highlights the need to be aware that crop damage can occur from changing machines and fertiliser placement techniques. The crop was sown into a sandy loam soil, which was moist. Agyield at 50 kg/ha and urea 90 kg/ha were banded as a mixture about 8 cm below the seed. This was placed in a slot which was closed and the wheat seed planted immediately behind.

The farmer estimated that 70% of the fertiliser was in the bottom of the slot and the rest was distributed between the bottom and the seed zone. There was no rain for about 10 days after sowing. Germination and emergence of the crop were very poor compared with similarly sown crops planted before the rain or a crop sown with urea topdressed before sowing. Soil pH was elevated throughout the soil, from the bottom of the slot to the seed zone, due to the banded fertiliser.

The poor germination and emergence was due to the toxic effect of gaseous ammonia produced from the urea as it broke down. Because the row spacing was increased to 30 cm, the concentration of the fertiliser in the band was effectively the same as about 150-160 kg/ha of urea and 85-90 kg/ha of Agyield, as if an 18 cm row spacing was used.

Alkaline soils are usually needed for gaseous ammonia to be produced. However, urea produces its own alkalinity during breakdown. Normally ammonium fertilisers, such as Agyield, would not produce ammonia except on alkaline calcareous soils. However, in this case, the Agyield was mixed with the urea and the alkalinity from the urea could have resulted in some ammonium N from Agyield being converted to ammonia and contributing to the problem.

The germination problem could have resulted from the failure to place all the fertiliser at the bottom of the slot, but some of the effect may have been due to ammonia gas percolating through the drying soil into the seed zone. This would be avoided if the fertiliser could be banded to the side as well as below the seed.

TRAMLINING FOR NO-TILL?

Paul Blackwell, Research Officer, Geraldton (099 210555)

Tramline farming or controlled traffic keeps most of the heavy wheels running on the same area each season. This aims to:

- Minimise accumulated compaction,
- Reduce power requirements with less rolling resistance and draft force,
- Improve traction in wet conditions and
- Improve the accuracy of spray and fertiliser application, with reduced reliance on foam markers.

Research evidence to support these concepts is still scarce for dryland cropping in Mediterranean climates. However evidence from Queensland may assist us in the possible effects of tramline farming on fuel use and efficiencies. I was privileged to attend the National Controlled Traffic Conference in Rockhampton in September. A wide range of research information and numerous case studies of farmers adopting tramlining were presented.

Irrigated row cropping has accepted controlled traffic as the normal improved practice. However, application to dryland farming, especially on non-clay soils, is less clear. A major limitation to dryland adoption is an inability to keep the wheels on the tramlines. However, some farmers are making it work by using bare tracks with bout markers. There are also some interesting developments of visual guidance systems and, possibly, improved GPS systems.

The results most immediately applicable to WA come from a paper by Brian Rowbottom of the Bundaberg Sugar Experimental Station and Peter Walsh of QDPI Toowoomba. They studied a reduced till and a zero till operation for dryland wheat on a 2,000 ha farm in Central Queensland, using an 18 m boom and a 16.6 m seeder. Reduced till wheeled 55 % of the paddock, while zero till wheeled 28 %, this assumed no deliberate traffic control, and a 5 % overlap for all operations. Tramline farming reduced the area in both systems to 12 %.

A preliminary economic analysis, used a draft reduction of 35 % and tractive efficiency improvement of 10 %. Based on previous research results a 32 m seeder could then be pulled instead of an 18 m seeder (due to improved traction and reduced draft) with a $7/ha cost reduction for no-till operations.

The analysis took no account of yield improvements from controlled, rather than uncontrolled traffic, or more efficient spraying and top-dressing operations or less crop damage from multiple wheelings. Remembering that it is for Queensland clay soils and not WA loamy soils.

However, it is important to consider whether or not similar changes to tramline farming may improve the efficiency of your operations. Hopefully there will be more research in the forthcoming years to help clarify such ideas. Trials at Yuna and Morawa (Graeme Malcolm on 099 715 002) from 1990 have shown the practical feasibility of tramline farming, contact Graeme if you need more details.

Farmer Section

WE TOOK 3 YEARS TO CHANGE

Bevan Olden, Morawa (099 714027 p&f)

There were several main reasons why we felt unhappy with our more traditional systems. Ploughs and scarifiers were breaking the soil down very fine which caused surface crusting, gave variable seeding depth and many of our soils would blow when dry. We also think our pre-emergent herbicides were being diluted by cultivation.

In 1993 we cultivated with 50 mm wide (2 inch) points and seeded with 180 mm wide (7 inch) points. Then in 1994 we tried some cultivation with 50 mm wide points, which was after 6 years of pasture and we seeded with 50 mm wide points. From cutting down our cultivations we observed; less fuel use, less point ware, less time used, much better pre-emergent herbicide effect, smoother paddocks, less sandblasting or crusting and a more even crop germination.

This year we cultivated only those paddocks which had brome and barley grass and this was done in March. This year we adapted a 10.1 m Alfarm bar with 5 rows using tines with break-out pressure of 140-180 lbs/ft. We pull this with a 4640 John Deere having 180 hp. We used Super Seeder points and had good results. The remaining crop was sown with Super Seeder points at 75-80 mm deep at 12 kph. Our seed was placed in the bottom of the furrow which filled, without harrows, to cover the seed with 40-50 mm of soil.

We observed some extra benefits in 1995 as well as the 1994 benefits. We noticed; the soil between the furrows is fractured - yet still soft, good early growth, less soil disturbance with no run-off and better point penetration. However, our knockdown did not work so well. We again used less fuel, saving $2,000 on 1994 and $5,000 on 1993. In the previous two years we changed points often, however this year we used the same set all season. So far our Keiv lupins have podded well and our barley also looks good.

LOOKING FOR THE RIGHT MACHINE

Tim Officer, Coorow (099 521077 p&f)

We farm 1,150 ha on a big range of soil types, from deep non-wetting sand to hard setting clays. We crop about 180 ha of lupins and 360 ha of wheat, half on lupin stubbles and the rest after 2 years of variable pastures. We run about 2,000 sheep. My wife is intimately involved with the running of our farm. Our move into no-till has been over many years as we looked for the best system to suit us.

In the early 70's my light land was blowing away from overworking. I then began experimenting with SpraySeed and direct drilling on the light soils with some encouragement from ICI to also try some heavy land. By the early 1980's we were establishing all our crops with direct drilling. There were many sceptics in the early years.

Our yellow Chamberlain combine gave poor penetration on heavy land and sowed too deep on light and uneven paddocks, as we tried to get a full cut. We then tried a 40 row Shearer which followed the ground and dug better but easily blocked with trash.

When Chamberlain brought out its 700 series Combine we traded in our disc plow, which we had not used for 8 years. The new Chamberlain dug better, with the right point, and gave better seeding depth but did give more surface soil disturbance. This dried out the topsoil and, on some dry starts, we had fertiliser toxicity when we drilled nitrogen with the seed. We fitted split cups and dropped the fertiliser on top, but sadly this fed the weeds also. Our lupins were culti-trashed into standing stubbles and our sandy soils have become more non wetting which gives us poor crop establishment.

This newer combine could not seed lupins into thick wheat stubbles. Although we did improve trash flow with wider row spacings and using narrow points but this was time consuming during seeding. This seeder could not follow the ground nor therefore guarantee accurate depth control or furrow formation. Wheel marks, from topdressing urea and harvesting, on paddocks that were ripped in the previous wheat crop, made accurate seed placement with this machine impossible.

Obviously we needed a ground following machine for all soils for our small operation. This was a big ask! We needed a machine that could penetrate hard ground while maintaining seeding depth, cultivate and band fertiliser below the seed, furrow sow in sand without excessive disturbance and handle stubble.

In 1994 we looked at the Ausplow DBS as a bolt on to existing tines but our tines did not have enough break out pressure to dig into our heavy land.

I saw the Garnell modules at field days and saw the units demo'd. With assurances from the agent as to what it would do, we fitted them, with difficulty, under a Forward 853 combine box. They worked well in sand, creating a ridge and furrow system, but they could not cultivate or band the fertiliser below the seed. On the heavy land the beak point moved too much soil with none left to bury the seed and it had limited stubble handling ability. We spent many hours, with the agent, trying to make them work. To the agents credit he stood by his agreement of guaranteed satisfaction, which enabled us to negotiate out of that system.

This year we purchased the new Ausplow DBS on a hydraulic tine fitted to a float frame for the 853 box at 250 mm spacings. Delivery was delayed. Some lupins had to be sown before delivery with the culti trash. We did not use the cultitrash on our worst non wetting paddocks. We have much improved plant numbers although they are several weeks behind. The heaviest stubble we sowed through and without any trouble was a 2.0 t/ha Cadoux crop which was harvested with a comb front.

We had some problems with the air system to get the seed and fertiliser to the widely spread tines and some trash did build up around the seed tube. The wheat establishment in light and heavy soil was very acceptable.

The main **benefits** from our new system, include;

- furrow sowing gives vastly better lupin establishment,
- we get accurate seeding depth across all soils, including uneven soils,
- we avoid fertiliser toxicity by placing the fertiliser below from the seed,
- we cultivate below seed with minimal surface disturbance with less wind erosion,
- we can continue sowing into heavy land even with the surface soil drying out,
- we can retain soil moisture and
- better soil structure.

Our **drawbacks** and **learning** experiences include:

- the machine was expensive,
- the cost of more knockdown and perhaps two sprays, a split spray was needed,
- the need for wider row spacing for stubble handling and furrow sowing,
- we need to seed a bit slower (8 kph) to maintain our ridge and furrow pattern,
- possibly more brown spot on young lupins as soil splashes off ridges, but the lupins grow away from it,
- perhaps more wheat seedling root disease where unburnt grass was left—the soil is not scattered as with direct drilling,
- some simazine applied post sowing washed into the furrows and
- less opportunity to graze early pasture.

Weed control techniques need some adjusting. We found it important to keep the weeds small prior to seeding, otherwise sowing had to be delayed to allow the weeds to breakdown. Spraying ahead with low rates of knockdown proved very worthwhile. On non wetting sands killing even young grass weeds with Roundup was difficult and we needed a second spray with SpraySeed to completely kill them, this information was available I just had not done my homework properly.

In conclusion, make sure you get the machine that suites your needs. With regard to row spacings, I am not sure, the jury is still out. But at this stage I think that 250 mm spacing is acceptable. Make sure you get your knockdown recipe right as it is unforgiving if you don't and avoid applying simazine post sowing with ridge and furrow lupin sowing.

TOTAL NO-TILL AT CHILIMONY-BOWES AFTER 1993

Digby Lee-Steere, Northampton (099 362 033 p&f)

With the success of the Biomax No-Till in 1993 with some Spear wheat going in excess of 5 tonnes, we decided to go total No-Till in 1994.

With our Flexi Coil 800 bar we took off nearly half of the tines for a 300 mm row spacing and bought the Primary Sales adaptor and super seeder points. We had a lot of trouble with the adaptor and the point kept breaking in half. But with a lot of help from Alan Fisher we developed a stronger adaptor and a stronger Super Seeder point which gave no more trouble. We added a Woolfood chain harrow to the back to level the straw, cover tracks and incorporate chemicals.

We saw no difference between the crops sown at 300 mm row spacing and the other crops in the area and the harvest results backed it up.

At Kalannie, in August 1994, it was mentioned that people did not get into No-Till because of the cost. Well I don't know who is fooling who, because it is far cheaper to No-Till than Till, and with the wider spacing we had no blocks even in our 4-5 t/ha wheat stubbles.

This year we have had an absolute dream start to the season. With 19 mm of rain falling on 29 March, 3 mm on 8 April, 25 mm on 22 April, 48 mm on 28 April and 23 mm on 29 April. But one of the hardest things to do with No-Till is **do nothing for 7-10 days until after the break** because your boom spray is your plough and most weeds take that long to get through. We started lupins on 26 April with the Biomax and they are just starting to show a flower pod and look excellent.

The Flexi Coil 800 bar started seeding Hyola 42 (canola) on the 27 April, with knife points. Unfortunately we made a $5,000 mistake, we bought 1,000 kg of seed to do 200 ha but we only got 100 ha done, it was sown at 10 kg/ha instead of 4. We went onto wheat while we waited for more canola seed. Well you should see the No-Tilled canola, at the end of June it was 30 cm high and starting to flower and currently, after 175 mm in July, has finished flowering by mid September and looks like a 2.5 t/ha crop.

Despite this very wet July our farm has done extremely well with No-Till. We have had no water or wind erosion, no yellowing of crops and no waterlogging. It is surprising, and I find almost unbelievable, that there is still much resistance to the adoption of No-Till. Just what's going on? Why have people coined the phrase No-Till, No Crop, I would love to show the sceptics over my farm this year.

Because of our No-Till seeding technique we were able to finished our 5,100 ha seeding program by 26 May. Consisting of 2130 ha of wheat, 2030 ha of Merrit lupins, 670 ha of Keiv lupins, 200 ha of canola and 30 ha of chickpeas. During the second week of June, we had very strong winds and a lot of farmers paddocks were badly blown and **eroded**. When will they learn to use **No-Till?**

NO-TILL WORKS!

Tony White, Miling (096 541025 or 54 fax)

Our first experiences with No-Till was July 1992. Our lupins were wind blasted and we needed to reseed them. We used a 9.1 m Great Plains machine. A local machinery dealer hired it out for farmers to see No-Tillage on their own farm. It did a great job of re-seeding because it did not disturb the soil and did not kill any more lupins.

The following year (1993) we direct drilled most of the crop and did not think much more about No-Till because we were getting along quite well. We had the usual 3-4 extra people working for us, driving tractors around the clock.

In 1994 we burnt many paddocks, like nearly everyone else. We did most of our burning in the middle of May so that we could avoid the big wind blasts we sometimes got before the opening rain. The paddocks took off with the wind. I would hate to guess how much topsoil was lost around the district during that wind. We direct drilled all the crop once again. We burnt mainly because of limited trash flow with our 29 and 30 tine scarifiers and our two 511 International combines.

After the strong winds, and a dry start to 1994, we took a good hard look at our seeding methods and machinery. One of our biggest problems was the establishment of our lupin crops. We could see the need for some type of press wheel and a deeper cultivation below the seed. We also wanted a machine with some width so that we would not compact the ground so much.

I was fortunate to be able to join the No-Till tour of North America and Canada. I am grateful to the people we met and for their willingness to share their knowledge about No-Till systems and their hospitality. Interestingly, they are no longer comparing No-Till with conventional cultivation where we visited, they are busy testing No-Till seeding methods against each other. In this respect, we are a long way behind! The longer the tour, the more I became a convert to No-Till. I recommend the tour to all and it is a great way to see other countries.

The dry season last year was the other reason for turning to No-Till. After talking to many people and seeing that you can produce the same if not better yields with No-Till we had to give it a go. We could not see any reason to fully cultivate the ground except for weed control.

So we had a look around at the different types of machinery. We trailed the Great Plains drill with leading wavy coulter. This machine had done over 3,000 acres for the season around the district and we thought that this would be the true test of the machine. We had only sown 4 ha of barley and we struck problems. First a wheel fell off, then the fertiliser shaft seized and then we couldn't get enough pressure on the presswheels (and the cockies ate the seeds). Also, it did not corner very easily.

We decided that No-Till had to be kept simple and not too expensive. Many people have bought big machines, for both direct drill and No-Till, only to find that they are restricted to what they can do. Often tine break-out is too low and tines are fixed. We knew we needed to find a machine for our peculiar needs and we needed to make our farm sustainable.

So we looked at our options of: buying new gear, converting our combines, modifying secondhand machinery or do nothing! Buying new gear was out of the question as many machines had not been proven for a full season in our local conditions. Converting the combines was a serious option because my brother is a mechanic but there was no guarantee on their re-sale value once modified and banding fertiliser would have been difficult. So we decided to modify second hand gear. We found a 35 tine Shearer Trashworker and a 5700 International Airseeder and set to work.

First we changed the tines to 300 mm spacings by adding some extra hydraulic hose and a couple of extra tines. Then we made a bar to hold our seeding tubes on the back of the trashworker (copied from Graeme Malcolm). We then bent the seeding tubes and bolted them on. For a depth controller we used $15 pneumatic golf buggy wheels bolted to the seeding tubes. We used a Holden bonnet spring as a tension spring. We easily split the seed and fertiliser (double airseeder heads and hoses). Our fertiliser system was exhaust tube squashed together and bolted behind the tine with the airseeder hose into it. We blocked off every second seed outlet and did the same with every first and third outlet in the fertiliser tank. We bolted DBS points, with a 100 mm long blade, onto the tines - after a very long wait for their delivery.

The press wheels did a good job as a press wheel in nearly all conditions. They even handled doublegees well because the point grades away in front and the soil is generally damp and soft. Unlike other costly press wheels they do not build up in our clays.

After about 10 weeks of work we had a machine that would seed our 1995 program. It cost about $2,000 in steel and bolts, $600 in golf buggy wheels, $1,200 for the DBS points and a bit of our time.

We then put the new machine through some long dry stubble, but the seeding tubes on the back kept blocking up. We had broken the number one rule with No-Till farming of preparing stubble at harvest. The stubble needed to be cut shorter. After 15 mm of rain we had another go, but surprising, this time it did not block, the wet stubble went through better.

The lupin paddocks were sprayed with 400 mL/ha of Roundup and 2.5 L/ha of Simazine then No-Tilled with 100 kg/ha of Gungurru. The lupin germination is our best ever and the lupins have obviously benefited from the deep banding and cultivation. The Simazine was incorporated by rain only and 300 mL/ha of diuron was used for doublegees.

For seeding wheat into lupin or pea stubbles the No-Till method is best because of the deeper cultivation and minimal soil disturbance. All wheat was sown at 55 kg/ha. On pasture country it also did a good job. The germination rate is a lot better because of the light pressing of the seed and soil. I used 1 L/ha of Pacer on pasture paddocks because I had to make sure the weeds died. Normally, I would use 500 mL/ha of SpraySeed just before seeding. Trifluralin at 1 L/ha worked well on lupin stubbles. Diuron at 750 mL/ha and 10 g/ha of Logran seems to have worked quite well on pasture paddocks.

We were mixing 55 kg/ha of urea and 50 kg/ha of DAP and banding it under the wheat seed. For the lupins we were banding 100 kg/ha of SCZM. We seeded 85% of our crop with the No-Till method this year and are happy with our establishment. A few observations that we made are:

- The furrows harvest water.
- All the fertiliser is where you want it.
- Water does not pond on the paddock, it infiltrates.
- 2-3 days after 25 mm of rain you can generally get on the paddock to spray it.
- The DBS points wore out after 900 ha—need more tungsten up the blade.
- Our banding boots need to be modified.
- Hydraulic tines give you a lot more flexibility.
- Hydraulic tines ride very smoothly.
- We needed 5 hp per tine.
- Reduced tractor hours.
- Reduced labour.
- Increases boomsprayer workload.
- Use extra knockdowns.
- Need more technical support from advisers and agronomists.
- Rotations are very important.
- Insect monitoring is very important.
- 300 mm row spacings seems to work well.
- Look very carefully at a system before you jump in and use it.

NO-TILL IS GOOD FOR PASTURES

Greg Ricetti, Cordering (097 363060 p&f)

I farm 1,000 ha of arable gravel loams at Cordering 25 km south of Darkan with 550 mm average annual rainfall. I have been predominantly a wool grower, but growing some oats for stock use with any surplus sold in winter. I started growing barley and extra oats in the late 1980's and since the wool market crash I have increased my cropping area.

I have been spraytopping in the spring for pasture improvement since the mid 1980's, and as a consequence, my cropping system had evolved from a conventional two pass system, with spraytopping, to a one pass system in 1992. I put the combine behind the scarifier and, apart from some depth control problems, the result was quite satisfactory.

About then, my neighbours, the Harrington brothers, introduced me to No-Till . They had cropped several adjoining paddocks with their airseeder adapted to No-Till using knife points. Having grown up with conventional cropping and believing that a good ripping up was needed, this method seemed rather radical to me, to say the least!

I asked them why they did it and they said, by going to No-Till they could maintain most of their stock and include a cropping program into their farm. Near Darkan, we do not have big problems with wind or water erosion, apart from the occasional summer storms, to which No-Till would be an added benefit.

Having the sheep graze the paddock until seeding and not ripping up in early May (usually) gained an extra 2-4 weeks of grazing while the other paddocks could get away. (Editors note - in dryer cropping environments this technique has caused no-till failures as time of sowing is critical). The next plus was that we were not burying all our clover seed for the following year so the paddock returned to a near normal carrying capacity the next year and not taking 2-3 years to re-establish as with conventional cropping.

At the end of 1992, I was fortunate enough to have my neighbours trial No-Till on 25 ha of barley. The trial yielded marginally better (one bag) that the rest of the paddock probably due to the better depth control. This paddock was stocked post-harvest, as usual, and by March the difference between the trial and conventional was very noticeable. The stock had "churned up" the stubble that was conventionally grown whilst the No-Till area had hardly moved.

With similar yields and the benefits in stock management evident I believed that the No-Till system was the way to go. I then attended the first WANTFA conference in Darkan, and decided to convert my existing combine (an A-62 1H) into a No-Till machine using a knife point with a furrow closer. I used Janke spring assemblies and designed a tine and point to fit. With the help of an engineering firm we made up a heavier undercarriage and bolted our assemblies to it. Amid many alterations, modifications and frustrations I got the crop in, albeit a bit late.

The 1993 season was quite reasonable and I ended with reasonable yields, all things considering (2.5 t/ha barley and 3.0 t/ha oats). I then proceeded to fine-tune the combine for the 1994 seeding by fitting a third row for better trash flow and lifting the grain box for grain flow.

Having found tungsten to be the longest lasting of hard facing treatments I fitted two blocks of tungsten to the base of the points and used WMR (tungsten filler rod) above. Once I adjusted the tine breakout pressure to 80-85 kg, I had excellent point wear. Greater breakout pressure broke the tungsten hard facing. Apart from some hassles with the Janke spring assemblies I had a reasonable run.

Last season was only ordinary with my yields being down but acceptable (2.2 t/ha barley and 2.1 t/ha oats). My grain quality was good with minimal screening or pinched grain, which I attribute to better water retention with No-Till.

I have found that with No-Till good weed control is essential with spraytopping the year before most important. The knockdown spray has to be spot-on or big problems can occur post emergent. Without cultivation both clover and geranium have become problem weeds and last year I used Glean and Ally at low rates (3-5 g/ha) on Stirling barley and Mortlock oats, tank mixed with Roundup (600-700 mL/ha) which did a good job. But in certain soil types these were too severe on the crop. I am confident that, as I gain experience with No-Till, my chemical costs can be reduced.

I have found that No-Till cropping enables me to crop 35-50% of the farm without greatly compromising my stock carrying capacity. The extra 2-4 weeks grazing at the break of the season, the better use of stubbles and the better return to pasture in mixed farming is of major benefit, even more so in a tight season like we have just had. The extra production obtained has been more than welcome with wool prices the way they are.

Converting an older type of combine has not been the best way to go for me. It costs time and money and I feel like I have modified and remodified, and I feel a bit modified out! I have now purchased a new Shearer combine and put an Agmaster seeding system with Harrington knife points under it and I am confident it will perform well.