TO MEMBERS

POSTAGE PAID

Western Australian No Tillage Farmers Association (Inc)
WANTFA

MAY 1995 *"NO TILLAGE—LEARN THIS CONSERVATION CROPPING SYSTEM"* NEWSLETTER VOL 3 NO 2
ISSN 1320-7059

INDEX

Topical Section...
WANTFA General Meeting At Morawa, 2-3 August, 1995 .... Kevin Bligh, WANTFA Secretary (Perth)
Know Your Soils Seminars—Available .... Land Management Society
Canadian No-Till Engineer Visits In July .... Kevin Bligh, WANTFA Secretary
Darkan Conference Report .... Kevin Bligh, WANTFA Secretary
Wantfa's SWOT Analysis .... Ken de Grussa, President (Esperance)

Science Section...
No-Till Seeding Systems With Trifluralin .... Steve Curtin, District Leader (Lake Grace)
Beware Of Wider Cereal Row Spacing! .... Ron Jarvis, Principal Research Officer (Perth)
Row Spacings And Tillage For Cereals Debate? .... Bill Crabtree, Development Officer (Esperance)
Less Tillage Improved Structure And Bean Yields .... Ron Jarvis, Principal Research Officer (Perth)

Farmer Section...
No-Tilling Worked Well At Kalannie .... Don Stanley (Kalannie)
Two Decades With No-Till At McAlinden .... Ray Honey (McAlinden)
Boots And All! .... Steve King (Lake Grace)
Fifteen Years Of Dry Land No-Till .... John B McNabb (a USA farmer)
(Proceedings - 16th Annual Manitoba-North Dakota Zero Tillage Farmers Assoc W'shop, '94)

Topical Section

WANTFA GENERAL MEETING AT MORAWA, 2-3 AUG '95

Kevin Bligh, WANTFA Secretary

The Koolanooka-Bowgada Landcare Group have kindly offered to host WANTFA's next General Meeting at 5.30 pm on 2 August 1995. The No-Till days start at 9.30 am and carry on with field visits the next day (3 August). For further information contact WANTFA Vice-President Graeme Malcolm on 099 715035 (p/f).

The meeting will cap off Ben Dyck's WANTFA-sponsored, three week visit to W.A. Ben has more than 30 years experience of seeder development with the Canadian Department of Agriculture at Swift Current, Saskatchewan. By then, Ben will have visited most regions and spoken at many No-Till farmers meetings with, doubtless, some words of wisdom regarding future developments.

KNOW YOUR SOILS SEMINARS—AVAILABLE

Land Management Society

An introduction to practical soil science as devised by Associate Professor Bob Gilkes (University of WA, Soil Science, School of Agriculture) and Natalie Hunt, (Department of Agriculture).

A popular, practical course for farmers, designed to identify problem soils and elements that influence productivity and management.

The course is "hands on" and will equip each participant with the knowledge of how to measure the following properties of soil and water on their own farms.

• Soil and structure • Soil drainage • Soil and water acidity • Soil and water salinity.

The course runs from 9am—5pm over one day. Groups are asked to provide a venue and overnight accommodation, if required, for lecturer.

This course is free to bona fide farmers—Thanks to the sponsorship of RAFCOR. Contact the executive officer of the Land Management Society (09 4506862) to book a ***Know Your Soils Seminar*** now.

CANADIAN NO-TILL ENGINEER VISITS IN JULY

Kevin Bligh, WANTFA Secretary

Canadian No-Till seeder specialist **Ben Dyck** has been sponsored by WANTFA to visit Western Australia from 15 July to 5 August. Ben has researched many No-Till seeder developments in Saskatchewan over the last 20 years. He also communicates well with farmers.

It is proposed to hold a series of regional meetings on the dates shown below. For further information, contact the WANTFA Committee members and Department of Agriculture people as shown below. Ben will then speak to groups in Adelaide and Horsham in Victoria before returning to Canada.

Date	Area	Contact person	Phone and Fax
Mon 17 July	Kojonup Darkan	Tim Trethowan Ray Harrington	(098) 341056 p/f (097) 363030 p/f
Tue 18 July	Wellstead Jerramungup	Jim Baily	(098) 471036 Fax 12
Wed 19 July	Esperance	Ken de Grussa	(090) 782026 p/f
Thu 20 July	Hyden Lake Grace	Geoff Marshall John Hicks	(098) 800018, Fax 38 (098) 201035, Fax 29
Tue 24 July	Northam Beverley	Mike Collins	(096) 226114 Fax 221902
Wed 25 July	Merredin Sthern Cross	Kevin Bligh	(09) 3683893 Fax 355
Mon 31 July	Kalannie Dowerin	Kevin Bligh	(09) 3683893 Fax 355
Wed 2 Aug	**Morawa No-Till Meeting**	Graeme Malcolm	(099)715035 p/f
Fri 4 Aug	Northampton Chapman	Kevin Bligh	(09) 3683892 Fax 355

DARKAN CONFERENCE REPORT

Kevin Bligh, WANTFA Secretary

About 100 members attended WANTFA's Annual Conference at Darkan on 21-22 February. Professor Bob Gilkes clearly showed how soil structure is improved by reduced and No-Till techniques. John Holmes and Paul Blackwell spoke on herbicide resistance and non-wetting soils, and Canadian farmers Gordon McPhee spoke about their situation, and the operation of the Manitoba-North Dakota Zero Tillage Farmers Association.

Narrogin farmer Mike Brown described his 19 years experience of No-Tilling. Interestingly, Mike considered the move from multiple tillage to direct drilling in the early seventies, a far bigger step than going from reduced to No-Till sowing.

Ten farmers from all over the State, then described their No-Till systems. The day finished with refreshments provided by seeder manufacturers and a barbecue arranged by David Harrington.

After WANTFA's AGM the next morning, trade representatives had equal time in front of the group to describe their wares. Thanks are due to Ray Harrington and the Darkan No-Till farmers for arranging the meeting, the speakers, and members and trade representatives who made it a success.

WANTFA's AGM decided, incidentally, to support the use of the terms " No-Tillage" (the term zero-till was not adopted), "direct drilling", "reduced tillage" rather than minimum tillage (being a confusing term) and "multiple tillage", only.

WANTFA'S SWOT ANALYSIS

Ken de Grussa, President, Esperance (090 782026 p&f)

As suggested in the last Newsletter, we may find it useful to do some analysis of WANTFA's **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats (SWOT). This was done at our recent AGM, see below:

Strengths
Cost reduction (fuel/labour).
More retained soil moisture.
Area specific tillage practices possible.
Industry association exists.
Makes farmers think about sustainability.
Innovation.
Reduced erosion.

Weaknesses
Weed control.
Limited chemical knowledge.
Lack of systemised approach.
Lack of long term trial data.
High cost of some new machines.
Environmental concerns (chemicals).
No new chemicals & technology, (formulation & application)

Opportunities
Soil structure improvement.
Improved competitive ability
Soil conservation.
Better systems approach—will manage herbicide resistance.
"Green" strength, like less soil erosion and energy efficient.
Forcing a re-think of standard agronomy.
Enhances use of contour working, tree belts.
Earlier timing.

Threats
"Old age" Resistance problems.
Push for chemical free agriculture.
Keeping old herbicides updated.
Choosing the best way to go.
Tunnel vision—negative thinking Salesmen!

Science Section

NO-TILL SEEDING SYSTEMS WITH TRIFLURALIN

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

Introduction:

This article follows on from Philip Hawker's which appeared in the previous edition of the WANTFA Newsletter and concludes the work carried out last year between the Department of Agriculture and Elders. In 1994, three trials and two demonstrations were set up in the Lake Grace advisory district to examine the effectiveness of Trifluralin rates and application strategies under No-till systems. We also wanted to evaluate these systems as a means of combating herbicide resistance.

The No-Till used in these trials was with knife-edge points which cultivate below the seed and leave the inter-row soil intact. All systems investigated involved the use of rotary harrows to help fine up the soil thrown onto the inter-row thus preventing volatilisation and also to put chemically treated soil back over the sown row. Trifluralin was evaluated under the following situations:

- rates from 1.3-3.5 L/ha.
- immediately before seeding (IBS) compared to immediately after seeding (IAS) and incorporated.
- in comparison to Glean® and Hoegrass®.
- in a No-Till versus a work up and seed option.
- with Diuron as an additional means of weed control.

— COMMITTEE —

"To routinely receive a copy of this Newsletter, join WANTFA by mailing $20, together with your name address, phone and fax numbers to "WANTFA Inc.", c/- Kondinin group, P.O. Box 913, Cloverdale 6105."

Results and Discussion:

Points discussed in Phil Hawker's article were:

- There was no significant reductions in wheat numbers at emergence for any treatments.
- Diuron didn't appear to have any effect on wheat emergence.
- Ryegrass numbers were reduced by about 80% using Trifluralin.
- There was no clear trend of reducing ryegrass numbers with increasing Trifluralin rate.

Other observations that can be made from the ryegrass and panicle counts and yield data are:

- Working up before seeding increased ryegrass germination by 45-100 % over No-Till sowing.
- Diuron IBS or IAS in addition to Trifluralin made little difference to ryegrass numbers initially but there appeared to be some ongoing weed suppression. This is reflected in the yield results.
- Glean® was more effective with No-Till than with conventional sowing.
- Collecting seed at harvest reduced ryegrass seed levels by at least 50%.
- Burning header rows reduced ryegrass numbers by 80%.

Summary of Individual Trials:

1. Kondinin, at T Wilkins':

Both No-Till and minimum tillage treatments gave similar grain yields, despite less weeds being present in the No-Till systems. Trifluralin decreased wheat numbers by 10% (but not significantly) which could have been overcome with a higher seeding rate or by removing the harrows. Pre-seeding cultivation always increased ryegrass numbers.

Glean® gave twice the ryegrass control, under No-Till, compared to minimum till. This made the Glean®/No-Till treatment the highest yielder. However, the No-Till plus 2.0 L/ha of Trifluralin did not yield significantly less. Conversely, Trifluralin worked better under a minimum till system rather than in a No-Till. Increasing the Trifluralin rate from 1.3 to 2.0 L/ha always gave better ryegrass control and grain yield.

Collecting ryegrass at harvest time was effective at lowering weed burdens for the following crop, and made all herbicides more effective. Stubble collected treatments yielded 10-20% more than stubble spread treatments, with an average improvement of 200 kg/ha.

Collecting the seeds did not reduce ryegrass emergence as much if the soil was cultivated. However, the collection of ryegrass seeds in the No-Till treatment reduced ryegrass number by 38%. All herbicides reduced ryegrass by at least 40% when the seed was collected compared to spreading, except Hoegrass.

Seed technique	Herbicide type plus rate per hectare	Ryegrass counts (/m2) Stubble collected	spread	Grain yield (t/ha) Stubble collected	spread
No-Till	Control	162	221	1.35	1.18
	1L Hoegrass	100	88	1.51	1.36
	15g Glean	50	85	1.78	1.62
	1.3L Treflan	48	95	1.57	1.36
	2.0L Treflan	42	71	1.63	1.42
	Average	80	110	1.57	1.39
Minimum Till	Control	231	221	1.25	1.03
	1L Hoegrass	117	131	1.44	1.32
	15g Glean	123	159	1.73	1.44
	1.3L Treflan	67	80	1.75	1.42
	2.0L Treflan	39	62	1.78	1.65
	Average	115	131	1.59	1.37
	LSD at 5%	57		0.17	

2. Hyden, at G Marshall's:

Increasing Trifluralin to 3.5 L/ha, decreased ryegrass emergence without affecting wheat emergence (left column, below table). Trifluralin IBS gave effective ryegrass control (79-84%), while IAS only achieved 9-41% control. The lighter harrows, used IAS, did not incorporate the Trifluralin well enough in this medium soil type. Above the 2.5 L/ha rate of Trifluralin IBS there was no additional benefit to Trifluralin.

Diuron additions to 1.5 L/ha of Trifluralin, IBS only, gave slightly better ryegrass control than Trifluralin alone. This demonstrates the advantage of Diuron as an additive under high ryegrass densities.

The high stubble levels may have required the higher rates of Trifluralin. Trifluralin at 2.5 L/ha IBS yielded the same as 1.5 L/ha Trifluralin IBS + 700 mL/ha diuron IAS both being 30% higher than the Nil. The highest yielding treatment was 1.5 L/ha Trifluralin IBS + 700 mL/ha diuron PSPE which yielded 47% better than the Nil. This is most likely due to the continued suppression of ryegrass. This treatment had the same panicle counts as 3.5 L/ha of Trifluralin.

Herbicide treatment	Ryegrass (plants/m2) Hyden	Varley	Grain yield (t/ha) Hyden	Varley
Nil	218	123	1.62	2.42
1.5 L/ha Treflan IBS	46	19	1.90	2.41
2.5 L/ha Treflan IBS	38	40	2.11	2.52
3.5 L/ha Treflan IBS	35	16	**2.17**	2.56
1.5 L/ha Treflan IAS	199	24	1.56	**2.89**
2.5 L/ha Treflan IAS	157	30	1.66	**2.85**
3.5 L/ha Treflan IAS	129	25	1.69	**2.90**
1.5 L/ha Treflan IBS + 700 mL/ha Diuron IBS	27	17	2.12	2.59
1.5 L/ha Treflan IBS + 700 mL/ha Diuron PSPE	34	34	**2.38**	2.62
1.5 L/ha Treflan IAS + 700 mL/ha Diuron IAS	92	22	1.52	**3.09**
LSD at 5%			0.28	0.18

3. Varley at C Henderson's:

This trial had relatively low ryegrass burdens as the site was crop topped last year. All herbicide treatments reduced ryegrass numbers in a similar order (by 67-87%, see above table). Increasing Trifluralin rates over 1.5 L/ha or adding diuron didn't have any additional benefit.

Wheat emergence was not affected by herbicides except for 3.5 L/ha Trifluralin IAS and incorporated, which reduced plant numbers but not yield. Similarly with Yield® at 2.5 L/ha. However, Trifluralin must have upset early wheat growth, because despite large reductions in ryegrass numbers, there was no wheat yield improvement, with the IBS treatments.

The poorer wheat growth on this sandy soil was thought to be due to the Trifluralin being mixed into the seedbed. The aggressive and heavy phoenix harrows broke up the inter row on this soil, giving a complete cultivation.

The IAS treatments were all significantly higher yielding than IBS treatments suggesting that applying Trifluralin IAS might be a safer technique on these on this soil type. However, previous experience shows this method not to be as effective on ryegrass, despite more crop safety. This method might be a practical option for achieving reasonable grass control and not affecting wheat growth where there are low ryegrass densities.

Again the lower rates of Trifluralin were adequate, as they were mixed in a small volume of surface soil with the ryegrass seeds.

Conclusions:

- Seed collecting systems at harvest followed by selective burning can effectively reduce ryegrass numbers and are a better option than spreading systems.
- No-till seeding systems will result in less ryegrass germinating in the crop. Additional cultivations will stimulate more germinations which puts more pressure on follow up chemicals.
- Although Tifluralin was effective under No-till seeding systems it performed better under a minimum tillage system.
- Trifluralin at 2 L/ha is a safe and effective rate under No-till systems. Rates are very dependent on incorporation and depth of sowing. There seems little advantage from increasing rates above 2 L/ha because with this method of seeding the Trifluralin is mixed in a small volume of soil. Even at this rate you should still only expect 80% control.
- Wheat plants on sandy soils, with harrows following, seem more prone to Trifluralin damage. Seeding rates should be increased by at least 10% until confidence is gained in your own seeding system.
- Under high ryegrass densities IBS applications of Trifluralin are more effective on ryegrass than IAS and incorporated applications.
- For IBS applications heavy rotary harrows on light soils may dig too deeply and break down the inter-row and cause damage to wheat plants. Rotary harrows were used to fine up the soil to prevent volatilisation and to put chemically treated soil back over the sown row.
- Light harrows are effective with IBS applications, but can be ineffective on heavier textured soils with IAS applications which require incorporation.
- Diuron PSPE was effective in providing ongoing suppression of ryegrass without any crop damage. Although 700 mL/ha was safe in these trials, damage could result on sandier soils. The PSPE treatment was more effective than when mixed with Trifluralin and applied IBS.

The results collectively show that Trifluralin is an effective and safe option for use in No-Till seeding systems, particularly where herbicide resistance is a problem. However, on its own it is unlikely to do a complete job and other methods which help get ryegrass numbers down such as seed collection at harvest, selective burning and croptopping also need to be considered.

The information presented in this article is the summarised results of three trials carried out in 1994 and is intended as a guide. Please consult your agronomist when interpreting the results to your particular situation.

BEWARE OF WIDER CEREAL ROW SPACING!

Ron Jarvis, Principal Research Officer, South Perth (09 3683481)

There appears to be a current trend towards pushing row spacings wider for wheat and other cereals. This follows the success with wide spacings for lupins. Farmers buying or building new seeding machines with expensive opener or tine assemblies see the chance to reduce costs by increasing spacings. There is also the desire to have one machine that suits all crops, plus the consideration of stubble handling.

Recent wheat row spacing work is verifying the work of the early eighties by Burch and Perry which showed that spacings wider than the standard 180 mm lost yield, and that yields could be increased by reducing spacings even further (to 90 mm). Glen Riethmuller's trial on sandy clay loam at Merredin has had five wheat crops in 6 years. 360 mm spacing has averaged 5.2% less yield than 180 mm (with 270 mm spacing being mid way), however 90 mm spacing has yielded 1.5% more than the 180 mm spacing. The average yield of the 180 mm spacing over the five years was 2.01 t/ha.

These results were from heavy land where a response to N would be unlikely and where tillage responses do not usually occur. Also Glen had all tines on the machine at 90 mm spacing for all row spacing treatments.

We could expect that on sandplain soils that are responsive to tillage, wide row spacings may suffer from the wider spacing as well as the reduced amount of tillage from having tines further apart. This was tested at a tillage responsive site at Wongan Hills in 1993. Overall for 360 mm spacing, Cadoux yielded 436 kg/ha (12%) less than for 180 mm spacing. However, with direct drilling with either SuperSeeder® points or with 50 mm points working 100 mm deep in line with the seeding points the loss averaged 565 kg/ha (17%). Where the soil had been cultivated or was deep ripped the reduction in yield due to wider row spacing (and hence less tillage) was less, (306 kg/ha or 8%) but still a sizeable amount.

The effect of the reduction of the tillage affecting the row spacing result was again shown at Wongan Hills in 1994. These treatments had 50 mm points working at 100 mm depth. Normal spacing of Cadoux yielded 1.72 t/ha. By doubling the spacing but leaving all tines on, the yield was only marginally reduced to 1.67 t/ha. When every second tine was moved, the wide spacing yield dropped to 1.45 t/ha (a 16% yield reduction). Deep banding the nitrogen fertiliser below the rows made no difference and this treatment yielded 350 kg/ha (23%) less than topdressing before seeding. Many points have to be considered when evaluating row spacing:

- the amount of tillage reduction as a result of the wider spacing;
- whether this is important on the particular soil type;
- the cereal species (at Esperance in 1994, barley (Skiff) yields did not alter with wide spacing but wheat fell despite the same tillage intensity for all spacings)'
- the seeding rate;
- the fertiliser type, rate and placement which can effect the toxicity, or the efficiency of uptake;

Generally we must accept that wheat will yield best with closer spacings. Trade offs such as reduced machine costs, better stubble handling, reductions in down-time for machine alterations from one crop to another, etc. will have to compensate for loss of yield as spacings increase from 90 mm.

ROW SPACINGS AND TILLAGE FOR CEREALS DEBATE?

Bill Crabtree, Development Officer, Esperance (090 761333)

Introduction

Many farmers who would like to retain stubbles and are already sowing lupins on 14 inch row spacings, see benefits in having their machinery set at one row spacing. This has rekindled interest in wider row spacings for cereals. Trial work in the early 1980's has shown up to a 20% yield loss when going from 7 to 14 inch spacings with cereals in some situations. However, these trials were conducted under certain conditions that may not reflect current farming systems. More recent work by Glen Reithmuller, again under certain conditions, has shown smaller yield penalties (<5%) from going to 14 inch spacings.

This paper attempts to explore many of the farm systems implications for row spacing changes with cereals. Due to all the interacting factors involved, there is little relevant data on appropriate seeding systems for different row spacings. The current system commonly being adopted is; No-Till, stubble retention, knife points or discs, usually deep placement of fertilisers and in the wheat lupin rotation. It is currently not possible to give simple recipes in this complex issue.

To claim that going to wider rows decreases yield may always be true for specific trial work and selective data may prove this. Trials always have comparisons. However, treatments within a trial may not sustain a factor that allows for other essential parts of the system to work (like burning, topdressed fertiliser and soil structural changes). Or, you may mess up a good management system by applying a certain treatment. Scientifically, we desire to change 1-2 things in order to determine the impact of that treatment on, usually, grain yield. Changing row spacings has implications on many things like:

1. Degree of soil disturbance,
2. Nitrogen mineralisation effects,
3. Weed dynamics,
4. Soil structure,
5. Earthworms and microorganisms and
6. Stubble retention.

Therefore presenting average grain yield reductions from going to wider row spacings, on the basis of two treatments, may not reflect systems realities. It wouldn't matter if the data set were robust and huge! For the sake of presenting a simple message we are in danger of coming to wrong conclusions.

Long Term Implications

There is a complex, yet real system example in central Victoria, where 720 mm (28") row spacings do not appear to have affected wheat yields (4-5 t/ha). The Postlethwaite's farm at St Arnaud in 375 mm rainfall country and have been direct drilling and then No-Till sowing for about 13 years in loams and clays which had lost soil structure due to cultivation and stock. They commonly sow wheat on 360 mm (14") row spacings with increased (doubled) grain yields compared to conventional neighbours on 180 mm (7") row spacings. On these degradable and dispersive soils, when combined with traditional and excessive cultivation, make it difficult to get optimal soil moisture conditions for adequate crop establishment and management.

The Postlethwaite's have adopted a No-Till, stubble retention system on wide rows. Chickpeas and lupins are on 720 mm row spacing's with canola and wheat commonly on 360 mm. Sheep are rarely and strategically used. Their soil conditions have improved so much that they can now sow and achieve good establishment in conditions that previously, with equal rainfall, would have made the soil either too sloppy or too hard.

Neighbouring farmers, who have not yet adopted this system, typically have several problems which now, rarely exist on the Postlethwaite's farm. Problems common to their degraded (cultivated) soils are poor emergence - due to crusting and seed bursting, water erosion - due to bad soil structure which doesn't allow the water to penetrate the profile and poor trafficability which hampers cultural operations.

The above example clearly challenges conventional wisdom regarding simple row spacing trial results. If we were to be simple thinking about this issue, we could say 'let's do a trial on their farm and see which row spacing wins?" I would suspect that if we reduced our row spacing to 90 mm we might increase their yields by 10-25% in the first year. Similarly, on degraded soil in the same area, we might improve yield by going to narrow rows, if you could pick the right soil moisture conditions to seed on. However, the extra cultivation on the Postlethwaite's farm could undo many years of soil structure building, particularly if the cultivation were sustained through many years. This is a systems issue! Interestingly, many scientific minds in Victoria, are having difficulty putting all the pieces together.

Many who farm in WA would have similar sorts of problems and would benefit from knowing of this Victorian experience. However, on sandier soils in WA, in a wheat:lupin rotation, the simple yield comparison, of a same day-trial (non-systems thinking), is likely to be negative for wider rows. But systems implications are a reality! Let's now consider, in detail, some of the factors that may influence whole farm grain yield outcomes with variable row spacings.

Extension workers and researchers in WA and worldwide are currently in a dilemma. The adoption of No-Till cropping has been too rapid for us to keep pace. Scientific workers have been unable to quantify and qualify many of the alleged effects from No-Till farming. We can not yet put it in a tidy package. Therefore, while this paper draws from much well understood theory, it also draws from observations without data with associated educated guesses. This is necessary for this paper to be useful in improving and exploring our thinking of how row spacing changes may effect or interact with farm system realities.

Degree Of Soil Disturbance:

With full-cut direct-drilling the whole soil surface is usually disturbed to 7 cm depth, but sometimes to 10 cm. No-Till sowing leaves undisturbed 'blocks' in the inter-row and has been defined by WANTFA as sowing with knife points or discs into undisturbed soil. The implements used vary in the amount of soil they throw and most can place fertiliser at 10 cm depth.

The wider, and the more forward angled the point will throw more soil than narrow and back angled points. A 16 mm wide, knife point is 'alleged' to throw the 30-60% more soil compared to a 12 mm wide knife point. Disc machines throw least soil and in some cases they throw none. The type and angle of disc(s), speed of travel, soil type and soil moisture all affect soil throw.

Increasing soil disturbance affects many soil properties. Cultivation increases the mineralisation of nutrients, the risk of wind erosion, horsepower requirements, weed emergence, weed vigour and the staggering of weed emergence. While more cultivation decreases the amount of rhizoctonia, soil structure, the ability to seed through stubbles, earthworm activity, trafficability and the risk of fertiliser toxicity. The impact of tillage, as affected by row spacings, on all these factors is complex. It is further complicated by rotations, soil types, environment, herbicide resistance, farm finances and a farmers attitude to all these factors.

Nitrogen Mineralisation Effects:

Increasing row spacings, decreases mineralisation of nitrogen at sowing, due to less soil disturbance. This can restrict early cereal (and weed) vigour and may need to be compensated for with additional applied N in some situations. However, this is not so on the Esperance sandplain, where adding N to wheat crops (4 t/ha) grown after lupins commonly decreases wheat yields (Smith and Mason, pers comm).

Narrower rows promote more rapid N mineralisation. Once mineralised, the N may leach, wash or volatilise from the soil. Long term soil management for structure will effect the degree of these potential N losses. A rapid release of N with tillage, followed by an irregular and small amount of N released through time will not be a steady N supply to developing cereals. The rate of N release may affect 'still unknown' grain quality factors.

The slow release of N with least tilled crops may also give slower early crop water use. Many farmers have seen No-Tilled crops mature 4-8 days later than direct drilled crops. This, no doubt, has grain quality implications! Many farmers report less cereal screenings with No-Till systems compared to more tillage systems. Since, less tillage gives less N mineralisation and therefore slower early crop vigour, the wider row spaced crops are likely to receive a more consistent N supply.

Weed Dynamics:

It is likely that closer row spacings will compete better with weeds. However, full soil disturbance, as with direct drilling, stimulates more weeds to germinate, compared to No-Till sowing. These weeds can grow more vigorously due to a better supply of mineralised N and also the soil will be softer allowing faster weed root growth.

Direct drilling with wide points, spreads the seed and fertiliser about 3-6 cm across the row. Therefore direct drilling, may encourage more weeds to germinate, give more vigorous weed growth and give the weeds closer access to applied granules compared to cereals grown in a No-Till system. This effect is likely to be amplified with wider row spacings.

The undisturbed layer of soil between the rows, with No-Till systems, is often inhospitable for weed growth. The surface inter-row soil has little mineralised N, is more firm, has many surface weed seeds and often a layer of rotting weed or stubble material. The weeds that germinate in this inter-row area are located away from the narrow band of fertiliser, which is placed below the seed. The wider the rows, the further the weed roots have to grow to take up these applied nutrients.

With wider rows and less tillage using precision seed placement, knockdowns herbicides in-crop are more reliable. The window of opportunity, for spraying small emerging weeds in the crop is increased. Reliable and uniform crop and weed depths increase this techniques usefulness. The weeds are frequently only buried 5 mm and they usually germinate before the deeper sown crop. Gramoxone at 400-600 ml/ha is commonly used 5-11 days after sowing (as the cereal crop first emerges). Undisturbed weeds are less likely to germinate, except in water repellent soils.

Soil Structure:

Worldwide soil structural changes on loams and clays, show how least tillage techniques consistently give the best soil structure. With every decrease in depth, intensity and number of cultivations there is an increase in soil structure. Going from a direct drill, to No-Till, to No-Till on wide rows is likely to give decreasing soil disturbance and therefore increasing soil structural benefits. These benefits will increase with years of practice and cannot be calculated by using one-off row spacing trials, at the beginning of soil structural improvements.

The Postlethwaite's farm is an example of long term soil structural improvements. After several years of direct drilling, then a decade of No-Till, these farmers are doubling the district average and they are on wide row spacings. Improved soil structure from less tillage, which may include wider row spacings, means better trafficability and therefore better timing of pre, at and post seeding operations. In these sticky soils, using tine machines, at wide rows allows them to retain stubble which further protects the soil from structural damage.

On sandier soils, classic soil structure, can not be improved, however the integrity or firmness of these soils can be. Wider row spacings, coupled with less tillage and stubble retention, will keep continuous soil pores from plant roots and earthworm channels open to allow water to drain and oxygen to penetrate the soil more freely. Slower mineralisation rates with No-Till will use less soil oxygen, possibly slowing the onset of waterlogging.

Earthworms And Microorganisms (Bugs):

Earthworms are evident in No-Tilled soils and they create pathways to depths that remain mostly intact with No-Till sowing. Closer row spacings and wider points will kill, damage and displace more earthworms than will wider row spacings. Earthworms locate their eggs mostly in the top 5-10 cm of soil and cultivating or shifting them from here disrupts their life cycle and their food supply.

Rapid mineralisation of organic matter, as occurs with full soil disturbance, at close row spacings, is not good for earthworms. Earthworms need a continuous food supply which cultivation indirectly destroys. Cultivation buries organic material which is rapidly depleted by hungry bugs in the soil. These bugs then experience a boom and bust in food supply.

After the bugs have eaten the organic material they then die, and are released to the soil in a more leachable form. All this usually happens within 2-3 weeks of cultivation, in moist soil conditions. Like earthworms, bugs prefer a slow release food source which occurs with wider rows, where more organic material is left on the surface. Earthworms prefer to feed on intact surface food, after which they burrow down, creating more soil pathways. Wider rows with narrower points or discs are least disruptive to soil life.

Stubble Retention:

Wider rows, with No-Till, more easily enables stubble retention. Stubble has many agronomic benefits. It provides food for soil life, it lessens the impact of rain splash which disperses soil and causes crusting. Stubble also rots down and can inhibit weed emergence and reduces soil erosion, from wind and water. Stubbles may also impede herbicide effectiveness, allow a build-up of both positive and negative animal life and stubble leachates (juice) may upset crop growth.

As stubble decays in waterlogged conditions, acetic and other acids are released and these can, if in sufficient amounts, retard or kill emerging plants. In these wet conditions, furrow sowing is likely to be detrimental, not only due to increased crop contact with leachates, but also due to waterlogging in the furrows.

Going to wider row spacings enables many seeding machines to sow through stubble. Having machinery that does not block will increase whole farm time of sowing. Using No-Till sowing techniques almost always involves furrow sowing.

The Downsides Of Wider Rows:

With knife point or double disc No-Tilling there is a risk of fertiliser toxicity and deep banding is beneficial for avoiding this.

Without a full-cut cultivation farmers will not be able to rely on a second knock effect on weeds and will therefore need to increase their rates of knockdowns. Many No-Tillers use glyphosate followed with SpraySeed before seeding which is a most effective technique.

On water repellent soils, furrow sowing is useful for catching water, but also can catch post-seeding residual herbicides and crop leachates.

We do not know what impact the wider rows could have on rhizoctonia control. Perhaps less fungal hyphae will be damaged and therefore rhizoctonia could do more damage to the crop. In emerging crops, at wider row spacings, there are more nutrients placed immediately below the seed and this may help the crop fight the disease better. The less soil disturbance may also allow other soil bugs to colonise the soil and compete with rhizoctonia.

Swathing may be more difficult with wider rows. Although some experience shows that 250 mm spacings, with mixers fitted to the swather, work well enough. Crop density, tillering and species also affect swathing technique. Legumes and canola at wider row spacings do swath well.

Monitoring soil fertility and pasture regeneration may be affected by wider rows. Narrow, deep and wide spaced applied fertilisers may be missed with the pogo soil sampler. Subsequent early pasture roots may find it difficult to pick up applied phosphorus in the wide and narrow bands.

Conclusion

Given all the interactions discussed, I suspect that going to 250-300 mm row spacings in many south coast farm systems, where No-Till and deep banding are used will not give whole farm and long term yield penalties.

I would encourage farmers to do their own experiments, in their own systems, with different row spacings. Other trial results are likely to be of some value, particularly where the system is similar to yours. In 1992, two trials at Jerramungup slightly increased wheat yield by doubling row spacing out to 360 mm rows, the phosphorus was banded at 10 cm depth in the wider spaced treatment, and these were 3-5 t/ha wheat crops.

Many factors affect grain yield outcomes. More work is needed for different systems of No-Till. It is likely that grain yield penalties, in many No-Till systems for adopting wider rows in cereals will be small and it must be viewed in a bigger whole farm systems thinking. You will not have to go far to find views different from mine outlined in this paper.

Interestingly, the same debate occurs in the States and Canada. Let me quote from a "Direct Seeding Manual" produced by PAMI and SSCA (Saskatchewan Soil Conservation Association) in 1994 on page 3-3 "*There is some controversy about the effect of row space on yield in direct seeding systems. Almost all of the western Canadian research conducted using conventional seeding systems and some data from direct seeding research indicates that reduced row spacing of cereals and oilseeds results in increased grain yield. For example research in canola has shown a 25% yield decrease resulting from an increase in row spacing from 150 mm to 300 mm. In contrast, research by Lafond at the Agriculture Canada Research Station, Indian Head, indicated no yield differences when using row spacings of 100, 200 and 300 mm. As a result, the issue of row space has not been completely resolved.*"

LESS TILLAGE IMPROVED SOIL STRUCTURE AND FABA BEAN YIELD

Ron Jarvis, Principal Research Officer
South Perth (09 3683481)

Faba beans gave better grain yields in 1994 at Merredin, on a long term trial site where treatments had improved soil structure. Better soil structure was evident on the plots which had a history of least soil disturbance (No-Till) and applied gypsum. The soil was a red/brown sandy clay loam (Salmon Gums/gimlet soil). The trials site, had been continuously cropped with wheat since 1977 using 4 tillage practices. The 1993 wheat crop was sprayed out with Roundup® in early September due to herbicide resistant ryegrass and wild oats. This "spring fallow" would have increased moisture stored in the soil for the faba bean year by perhaps 15 mm.

Fiord was sown at 152 kg/ha with 68 kg/ha double super on 25 May. All plots were direct drilled with a 12 row combine fitted with 50 mm wide points on 180 mm row spacings using seeding tines only. Light rolling harrows covered the seed rows.

Tillage history[1] 1991—1993	WSA %[2]	Faba beans '94 plants per m²	Faba beans '94 yield (kg/ha)
No-Till	16.3	35	1100
DDC	13.6	34	948
Cult/combine	8.0	35	858
DP (DDC)	11.2	36	812
5% LSD	3.0		174

Trial Details:

The **No-Till**ed plots were sown with a triple disc drill from 1977-86 and narrow points (50 mm wide) since 1987. The **DDC** was direct drill with a standard combine with 10 cm wide points since 1977. The **Cult/combine** was one scarifying 5 cm deep then sown with a TDD (until 1986) and a standard combine since then.

The **DP** (DDC) was "district practice" of 2 scarifyings (10 cm deep and 5 cm deep) before seeding with an standard combine. This treatment had the worst soil structure and yields until altered to DDC in 1987.

WSA being, water stable aggregate is a measure of soil structure as per cent (%) of aggregaes retained on a 2 mm sieve in a laboratory test.

Results:

The 1994 Faba bean grain yields were greatest on the treatments which had lower tillage history and better soil structure.

In addition, there was a 160 kg/ha (18%) yield response to applying 5 t/ha gypsum in 1983. This was despite WSA% showing a significant response to the gypsum in only three of the eight years measured since application (WSA averaged 22% higher over the 3 responsive years, where gypsum had been applied).

The best yield was from soils with least tillage history. The No-Till plus gypsum (in 1983) yielded 1.18 t/ha and the worst yield being after most tillage history, of two scarifying's before seeding without gypsum, yielding 0.73 t/ha. Similar work should be done for other grain legumes.

Farmer Section

NO-TILLING WORKED WELL AT KALANNIE

Don Stanley, Kalannie (096 662023 or fax 134)

Lupins:

We have had two successful years of sowing Gungurru and Merrit lupins with SuperSeeder® points. This gives us confidence to farm our soils in a more sustainable way. We have gained many benefits from No-Tilling lupins. These include, less hours and fuel, better Simazine use and probable soil structural gains.

We use two modified air seeders and have increased our row spacing to 220 mm (8 1/2") with increased track clearance. We use light rolling harrows, although coulters are being considered beyond 1995. When knockdowns are used, simazine is added to them before seeding. Brodal® and Fusilade® use, have aided our weed control program. We use 80-90 kg/ha of seed with 50 kg/ha of double super with the seed.

Our No-Till yields appear similar to conventional yields. We have not had any strict controls. However, about 800 ha were No-Tilled and 800 ha were direct drilled with either 100 or 150 mm points, and we have not observed any differences between the two systems in two years. Our yields have ranged from 0.4 to 1.6 t/ha, including some chemically damaged crop.

With the SuperSeeder® points we aim to work 100 mm deep and place the seed 30-50 mm deep. This has been achieved using conventional sowing tubes and travelling at 10 kph. We need to vary it a bit depending on soil type and moisture. Sowing lupins, with narrow points, into volunteer pasture country, was also very successful in one paddock.

Wheat and Peas:

Our No-Till results have equalled other techniques. Even in the dry year of 1994 with only 150 mm of rain, we still averaged 1.4 t/ha of wheat. We have a wide range of soil soil types and we believe timeliness of sowing is the key to success. We use Logran® as an insurance herbicide on the wheat, but hope to use it less. We pasture top the previous year, and try to keep our stubbles clean.

Our No-Till system is simple but effective. We have not yet used press wheels but use light rolling harrows. We are still learning the art of No-Tilling, and therefore consider a range of approaches. We usually have a paddock or two broken up after a summer rain to help us achieve the right seeding time. However, this year we have resisted the urge to cultivate after the January rain and have used glyphosate instead. It is really hard to sit 'apparently' idle while others cultivate, especially when you have cultivated after a summer rain all your life.

Benefits to No-Tilling appear numerous. We have had less run-off and bogs, with obviously less mud on our feet, especially after a rain in the soil where peas are grown. We can spray after seeding more easily, our fuel bill has been cut in half, there is much less maintenance, we have smoother paddocks and, we believe, improved soil structure.

TWO DECADES WITH NO-TILL AT McALINDEN

Ray Honey, McAlinden (097 322063 or fax 37)

I first experimented with No-Tilling in the mid 1970's with my neighbour's Bettison® Triple Disc Drill (TDD). I hired it to seed alongside some worked up soil. We controlled the weeds with two applications of SpraySeed, one pre-seeding, the second post seeding but pre emergence. Observations during these early days were that the TDD crops had less early vigour. This was probably as a result of no nitrogen released with no cultivation. However, as the season progressed the TDD crops appeared to catch up.

In 1979 we cleared our last patch of bush and in 1981 purchased a neighbouring property. During this period, most of the seeding work was done on well worked paddocks. We cultivated a lot, in order to level the paddocks and remove sticks etc. Despite this, we continued with No-Till also.

We used the Duncan® TDD machine from New Zealand which was more robust than the Bettisen®. We sowed new pasture varieties and oats as fodder for weaners. Typically using glyphosate once, sometimes up to 6-8 weeks after the break. Our sheep were removed the day before spraying, and we sowed immediately afterwards. The crops emerged as the weeds died off, so water erosion was eliminated.

In 1990 we established our first canola crop with the Duncan®, which produced just under half of the state's tonnage. Canola was used as the first crop in a continuous cropping program to help break up the soil structure with its root system.

During 1992 we trialed the Acra Plant® and Great Plains® double disc openers alongside the John Deere Biomax® and Duncan®. In 1993, we compared the disc machines with the narrow Harrington® points on barley and canola against the Acra Plant®. I was anticipating a response to cultivation with the narrow point, given that we had six years of sheep at 16-18 DSE per winter grazed hectare. We did get a knife point response but only with the barley, not the canola.

Now, after some experience with No-Till, I decided to put together one machine for, hopefully, all situations. I plan to encompass features such as stubble handling, cultivation under the seed, fertiliser banding and precision sowing with a press wheel. Being a member of WANTFA gave me the opportunity to gain from the experience of others, from at meetings, field days and newsletters.

I purchased a 27 run John Shearer® combine with a raised box in 1994. With the assistance of Steve Marshall at Dalyup, I built the L-PAC disc system (see last newsletter), which has been developed for better stubble handling.

The disc units were placed on the front row. I have fitted narrow points, with splitter cups, for banding fertiliser on the next 5 rows and seeding was achieved with the DBS units built by Ausplow®. These units were clamped to the 62° tines, carrying the narrow points.

Following was a rolling chain to smooth the surface. Most of the program was sown at 180 mm (7") spacing, with 360 mm used for lupins into wheat stubble. Siren canola was also sown on 360 mm spacing, after 2 L/ha of Simazine and 2 L/ha of Atrazine. It was interesting to observe that the radish only emerged in the seeding line, and not between the rows.

After two decades of No-Tilling, we have noticed many benefits to the system. Soil structure is visibly improved after 5 years, earthworm activity increases as cultivation decreases, water erosion is eliminated, our ability to travel across paddocks improves, more moisture is retained and at the same time improves water penetration, helping to prevent waterlogging. The return to pasture is good due to improved natural fertility and better soil structure after No-Tilling.

Our view is, that if we can just equal, or nearly equal conventional yields, then all the other benefits listed above, put us way in front.

15 YEARS OF DRY LAND NO-TILL

John B McNabb

Proceedings of the 16th Annual Manitoba-North Dakota Zero Tillage Farmers Association Workshop, Minot, North Dakota, January 31 - February 2, 1994.

The first experiences I had with No-Till farming were seeding winter wheat back into stubble ground with a regular deep furrow drill. After five or six rounds, I had a problem with straw plugging (pinning) so I finished the field (paddock) with a disc and then seeded the balance with the deep furrow drill. The next year, to my surprise, the first five or six rounds were the best grain I had in the field where I had No-Till planted. This beginning of No-Till seeding turned out to be the beginning of a great new sowing method for my farm.

At that time, I didn't really consider the major benefits of No-Tilling, which included controlling soil erosion and conserving soil moisture. I hadn't realised what was really taking place. Through the years, I had always tried to pull wider drills, wider chisels, and larger discs. So, when I would look at a 15-20 foot drill to do No-Till drilling without plugging, I just left the idea out because I thought I could never get all of the work done.

Later, I attended a No-Till conference in Canada where I learnt more about No-Till practices. I had been familiar with the Yielder Drill - 10 inch seed spacing with fertiliser deep bands between every other row at 20 inch centers. Then the real eye opener came. Yielder moved the rows to a paired row configuration of 5 inch seed row and deep banded in between that. When I saw the colored research slide of the seed roots growing towards the deep band I knew we had to make the 20 foot drill work. After analysing the additional carrying capacity of seed and fertiliser and greater drilling speed through the field in a one time operation, I realised it would work.

I talked to the manufacturer of the Yielder grain drill and negotiated with him to build McNabb Farms four 25 foot drills. We now run less than half the tractors we used to run and the tractors we do operate, operate fewer hours per year. We also found that, in using No-Till drills there is less dust, so there is less maintenance. The savings amount to about $35-40/acre.

The difference between 10 inch rows with deep banding, 5 inch away and 5 inch seed row with deep band, 2 inch away, is unbelievable. We now, would like more rows of seed with more deep bands to give more of a cross row feeding situation, especially in spring seeding.

There has been substantial discussion on whether or not fertiliser broadcasting is just as good as deepband placement. I have done it both ways and believe me, in my environment, deep banding the fertiliser is very important and much preferred over broadcast fertilising.

In years of favourable moisture, we can expect up to a 20% higher fertiliser response from deep banding over broadcasting of the fertiliser. Under drier conditions the advantage of deep banding over broadcasting may even double. These increases have been achieved while maintaining the same rate of fertiliser per acre.

Broadcasting fertiliser causes seed root masses to develop and grow close to the surface where the ground dries out first. Deep banding develops a downward trend of root masses where the moisture is located. Proper fertiliser placement is essential for the development of proper seed rooting patterns.

Through extensive, agricultural research in both the U.S. and Canada it is now well developed and proven to me, through my own experience, that deep banding of the fertiliser at the time of planting is far superior than any other method currently used. Here are some points to consider regarding fertiliser placement and rooting patterns.

- Plant roots must establish contact with fertiliser at an early stage of growth to achieve a high yield potential.
- Roots develop in a systematic manner that is genetically programmed into the plant.
- To ensure maximum fertiliser uptake, fertiliser placement should be adapted to the rooting pattern of the crop.
- Plant roots are not active in the surface layer of the soil when it is dry.
- Roots do not seek out fertiliser bands but grow into them by accident.
- Roots coming in contact with fertiliser bands will develop high concentrations of roots in the vicinity of the bands.
- Broadcast fertilisers by-passed by the first crop roots that develop, but this is not necessarily true for shallow-rooted weeds.
- Fertiliser placement can influence the depth of rooting.
- Broadcast applied fertiliser tends to encourage shallower rooted crops while banding below the depth of seeding can encourage deeper rooting.
- Deeper rooting can be a form of drought insurance.
- Use of starter fertiliser is not always necessary, but is most likely to be beneficial on cold, wet soils with low P levels.
- Precision placement of fertiliser to the side and below the seed row could be an effective method of providing early and uniform uptake of fertiliser by all of the crop.

BOOTS AND ALL!

Steve King, Lake Grace (098 719051 or faxs 54)

After a chat with Ray Harrington last year and Geoff Glenn from Agmaster we decided to try the Harrington points. We intended to do only 10-20% of our program this way and the rest with direct drilling. We had prepared the paddocks well for a one pass sowing anyway. The break to the season was patchy so we started with the knife points which kept the paddocks stable. Since things were going so well with the knife points we decided to keep at it and sowed 2,500 hectares like it. And guess what? It went really well!

We were not completely naive about jumping in, boots and all. We had the weeds under control in the previous year. We were in sensible rotations and our nitrogen levels were adequate. We knew the seed was getting into the ground, we were cultivating below the seed with the knife points and the paddocks were unlikely to blow.

We have a range of soil types and did plenty of trials over the whole farm. The Department of Agriculture from Lake Grace helped us monitor the trials. Our growing season rainfall was 150-178 mm, we planted lupins, wheat, faba beans and barley, either in rotation or after pasture. Our No-till sowing averaged more than direct drilling overall, though on some soil types the direct drilling was better.

Our wheat trial results are listed below. We planted Spear and Halberd wheat in the second week of June at 60 kg/ha. Fertilisers were Agrich and Urea, drilled at 120 and 20 kg/ha. We sowed wheat into pasture after 400 mL/ha of Roundup® and 30 g/ha of Logran®. Five soil types were tested, see below:

Soil type	Tillage used	Yield (t/ha)	Protein	Hectolitre weight	Screen -ings
Shallow	Direct drill	2.17	11.4	83.8	1.3
duplex	No-Till	2.04	11.3	83.0	0.1
Light red	Direct drill	2.42	10.9	83.0	0.3
loams	No-Till	2.46	10.7	82.8	0.2
Gravel	Direct drill	2.11	9.1	82.5	0.2
	No-Till	**2.51**	9.4	82.3	0.1
Yellow grey	Direct drill	2.10	9.6	82.8	0.3
loams	No-Till	**2.44**	9.4	83.0	0.5
Tamma sand	Direct drill	1.54	9.3	81.8	1.3
(Halberd)	No-Till	1.48	9.7	81.5	0.8
Average	Direct drill	2.07	10.1	82.8	0.7
	No-Till	2.19	10.1	82.5	0.3

We will be No-Tilling again this year. It appears that the gravels and yellow grey loams responded best to the knife points, while other soil showed little differences between treatments. However, we will do more trials this year again.