

# The no till, no sheep and 'knowledge' farming system

By Peter Norris, Agronomy For Profit, Geraldton WA

**N**o till, no sheep and 'knowledge' is the name I have given to our emerging farming system in Western Australia's northern wheatbelt. It is the system that is used by almost all of the farm businesses that employ my agronomy services. This developing farming system has a break-even rainfall on sand soils of around 150 mm – and on heavier soils around 175 mm. It is a vast improvement on production systems even those from the recent past.

What is the no till, no sheep and 'knowledge' farming system delivering?

## NO TILL

In 1993 Western Australian No Till Farmers Association (WANTFA) decided, after much debate, to define 'no till' as 'establishing crops with incomplete soil surface disturbance'. A pretty wide scope but this covered all of the techniques that were being used. Zero till is with disc seeders that disturb very little of the soil surface as they place seed and fertiliser.

No till crop establishment gives a huge number of benefits. The first is less soil erosion compared to tillage. WA grain growing areas had significant water erosion soil loss leading up to the change to no till. Wind erosion was also a much bigger problem in the past.

Crop residues are retained on the soil surface. This reduces evaporation and protects small plants from harsh weather events. Heavy stubble cover can reduce evaporation by as much as 50 mm during the season. This can give significant yield improvements.

Knife point and press wheel seeding systems have allowed much higher trifluralin rates to be used. This has been instrumental in getting back on top of ryegrass in the northern wheat belt. This is simply where the tine moves the treated soil into the ridge away from the furrow where the seed is placed.

This, and other techniques, have lead to a 98 per cent reduction in ryegrass numbers over eight years.

Row spacing generally used in WA range from 17 to 37 cm (or 7 to 15 inch), with 85 per cent of my clients in the North between 22 and 30 cm (or 9 and 12 inch), row spacing.



Peter Norris.

## NO SHEEP

The economics with sheep do not seem to stack up any more in WA. The economics in our part of the world are based on only three to five DSE per hectare which could only turnover \$120 to \$150 per hectare. Even 0.5 tonnes per hectare of canola is currently at over \$250 per hectare. There is not the exposure to profit potential with livestock.

There are only three places we can potentially justify sheep:

- Unarable country;
- Severe frost prone farms; and,
- Very acid low production eastern wheat-belt 'wodjil' soils.

Outside of these areas it is very difficult to justify sheep.

The damage their footwear does to soils is immense – particularly our sand soils that are exposed to wind erosion by grazing. On wet heavy soils they also plug the soil and greatly reduce water infiltration.

Grazing removes cover which is essential for improved rainfall infiltration – and then reducing evaporation once you have the moisture in the soil.

Cattle seem to do less damage. Plus they usually make you get to know your neighbours better and they taste (the catle) better!

No sheep on farm also adds about 300 extra hours to the cropping work or holidaying program.

## 'KNOWLEDGE'

Timing is usually the difference between good farmers and bad farmers.

The three costs in crop protection are:

- Yield loss;
- The remedy; and,
- Monitoring.

## Weed management

Integrated Weed Management means weed numbers are on the decline. Those farmers who creatively employ IWM are growing better crops due to very low weed numbers. Having a solid IWM program on farm allows tactics such as dry sowing to be employed with the confidence of not having a crop failure.

IWM is one of the key planks of this farming system. Pressure is still applied to the weed populations by herbicides but more is applied by non chemical control methods.

## Good strategic and tactical decision makers

Good rotational, soil health, machinery replacement and other strategies are in place in this system. The good farmers also make the right tactical decisions such as spraying out a poor performing broad-leaf crop in dry seasons and dry sowing some paddocks when the break is late.

These tactics generally have big benefits in overall long term profitability.

## Weather watchers and plan programs ahead

Knowing it is NOT going to rain is often as important as knowing that it is going to rain. Work is planned around expected weather conditions as a main driver.

## Nutrition

The nutrition 'bucket' on these good farms is kept full. Occasionally in dry years or extreme fertiliser prices, the fertiliser bank will be used. In the vast majority of cases more nutrients are being applied than removed. This also helps out with the building of organic matter in the soil.

Potassium nutrition and addressing soil acidity are big factors in added performance. Some growers also grow larger stat-



The no till, no sheep system has brought the break-even rainfall on lighter soil down to around 150 mm.

ured varieties to keep the stubble levels up and plenty of 'soil food' going back onto the soil.

#### Disease control

These growers are quickly onto any crop problems and address them as early as possible. Leaf disease is kept at bay with variety choice and triazole fungicides. The subsequent yield and grain quality benefits are now well established.

#### Crop rotations

Some rotations are set in concrete and many are flexible depending on the season. Those set in concrete tend to have a mix of country that suits growing of lupins, canola and wheat.

Common rotations:

- Barley/lupin/wheat/canola (agronomically ideal in medium and high rain areas).
- Wheat/lupin/wheat/canola (is also common).
- Lupin/Canola/wheat/wheat (gaining some more support).
- Canola/wheat/canola/wheat (will probably be more common in the higher rainfall areas).

In low rainfall areas the rotations have many more wheat phases due to the higher risk of broadleaf crop failure.

A typical rotation might be:

- Canola/three wheats/lupin/three wheats.

We also have the odd paddock of continuous wheat in these drier areas.

Further south there are areas where long term rotation trials have had continuous malt barley as the most profitable (non) rotation.

The key points are that there are no rules and you can choose crop sequences to maximise profit and/or to solve a weed problem.

#### Trying to build soil fertility

Most growers are achieving this through no till and plugging all of the holes in the nutrition bucket. The yield potential of this farming system is huge and growers need to be very aware of how many nutrients they remove in high production years.

### THE FUTURE

#### Weed seeker technology

This technology will reduce overall herbicide costs by allowing targeting of weeds or weed areas. A contractor is setting up in the Mingenew area and should be operational in 2009.

#### Shielded sprayers

They may prove useful but herbicide tolerant GM crops may negate the need for shields.

#### Precision Agriculture (PA) and Variable Rate Technology (VRT)

EM38 and radiometrics technology will be very good for zoning off heavy soils and ameliorating poor performing areas. This allows changes in input levels such as fertilisers and soil ameliorants and will change the cost structures in paddocks.

The problem here is which way to go?

Do you add inputs to poor performing country to get it to yield better or do you reduce inputs on the lower performing parts of the paddock and use them on the better performing areas?

Great care is needed with this technol-

ogy to make sure that you do not add to your overall risk profile when you move some inputs such as nitrogen.

Precision Agronomics Australia have demonstrated \$17 per hectare per year benefits in the Esperance area of WA.

#### Tramline farming

Improvements to the 'road and root bed' system will give huge benefits. The auto steer systems have given much lower overlap losses. Although this system is being employed on farms many still need a few good crops to match all of their machinery up.

#### GM crops

GM technology will be brilliant. Herbicide tolerance, although good, will not be the biggest advance that this technology will deliver.

Frost tolerance, acid soil tolerance, drought tolerance, and salt tolerance will be of much greater value to growers.

And I reckon that this technology can play a big role in pulling the world out of the current global recession.

#### Permanent ridges and furrows

RTK 2 cm steering systems may allow this to develop. I have not yet seen anyone do this but it would be brilliant. This revolves around creating 'curtains of fertility' and growing the crop only above the curtains. This concept would more likely suit lower rainfall areas but it is still some time off. I am itching for someone to have a crack at this concept. But we are getting close.

#### Improved soil ameliorant targeting

Gypsum, lime, soil wetters and so on, to increase overall farm productivity

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### Solving patchy problems

Issues such as shallow gravel ridges that damage seeding gear will be dealt with. There is one machine operating in WA (from South Australia) that is profile grinding these hard areas and 'rotary grinding' them down to a depth of around 250 mm. This solves machine damage issues and adds these usually productive areas to the arable hectares list.

### 'Voodoo' science

At the 2009 DAFWA/GRDC Crop Updates Dr Doug Edmeades (see [www.agknowledge.co.nz](http://www.agknowledge.co.nz)) spoke about science being under threat because of the modern philosophy of political correctness which infers that all opinions are equal.

The problem here is that they are not.

The scientific methodology is the only way you can gain confidence about a theory or a product. If it is rigorously tested, in appropriately designed trials, with untreated checks and the results are published in a reputable peer reviewed journal – then you can have confidence in it.

Organic food, the man made climate change debate, the banning of herbicides, the GM crop debate and holistic medicine are a few areas where rigorous science is being pushed aside.

Over time there have been many questionable products that have hit the agricultural market and are a flat out rip-off. You need to push promoters of these products for the replicated trial results. Buyer beware.

Those of us with a vested interest in the value of evidence based sciences (which is everyone!) need to defend the scientific process with vigour and yell down those who erode the place of the discipline of science.

### TO SUM UP

The no till, no sheep and 'knowledge' farming system has changed the landscape dramatically. The system is more robust financially, has stood up to resistant weed pressure and can better weather dry seasons. Growers need to look at the risk profile of their business and answer a few questions:

Do you put the blinkers on and rest on this knowledge and just seed everything from April 20 each year? Look at the long term annual rain for your area and see what your probability is of a profitable crop. If you are happy with the odds – why not just go seeding? And this is just what many are doing with great success.

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# Dynamic crop sequence trial: An Australian first

By Paul Carmody, Future Systems Analyst, DAFWA

A Dynamic Crop Sequence (DCS) trial at Katanning in Western Australia's Great Southern region, is the first of its kind for the Australian grain industry. The trial tests up to 100 different crop sequences in a crisscross trial design to address the question of break crop effect (see photos opposite).

According to Raj Malik, Research Officer for the Department of Agriculture and Food, WA based in Katanning, the only trials in the past that came close to this concept were trials by CSIRO's John

Kirkegaard. John looked at the effect of biofumigation properties of mustard and canola on the following cereal crop in south central NSW.

### Why do the DCS trial?

Now in its second year the DCS trial is investigating the reasons why farmers do or don't get a break crop effect from crops like canola, field peas, lupins or oats in dryland farming systems of southern Australia.

The trial site covers over four hectares. Crop treatments in 2008 (see Table 1) are crisscrossed with the same treatments in

**TABLE 1: Treatments for the dynamic crop sequence trial at Katanning, WA**

	Treatment 2008	Treatment 2009 – Cross sown on 2008 treatments	Treatment 2010 – Sown over entire site
1	Wyalktchem wheat with Jockey	Wheat plus Jockey	Wheat
2	Wyalktchem wheat without Jockey	Wheat minus Jockey	Wheat
3	Buloke barley	Barley	Wheat
4	Bravo canola	Canola	Wheat
5	Carrolup oat	Oat	Wheat
6	Carrolup oaten hay	Oaten hay	Wheat
7	Kaspa field pea	Field pea	Wheat
8	Jennabillup lupin	Lupin	Wheat
9	Green manure (Oat 50 kg/ha and Morava vetch 25 kg/ha)	Green manure	Wheat
10	Fallow	Fallow	Wheat



Raj Malik and Project Manager Peter White (DAFWA) at the Dynamic Crop Sequences trial site at Katanning.

2009 to establish 100 combinations of crop sequences for the final year of wheat to be sown across in 2010.

It is a large investment into understanding what the effects are of different crop sequences on wheat for – in the Katanning region – duplex soils of the southern wheatbelt. The trial is also unique because for the first time, it compares oaten hay and a manure crop in crop sequences. This ‘effect’ has been largely overlooked by past crop rotation studies.

The trial is part of a GRDC project co-funded by the DAFWA which will examine the place of break crops through bio-physical and whole-farm economic analysis. The work included a review of past research on break crops and factors that influence their use in rotations. This review has helped to formulate such an unusual trial.

Other DAFWA research staff assisting in managing the trial are Mark Seymour, Senior Research Officer and Pam Burgess, Technical Officer both based in Esperance.

The Katanning trial was established in 2008 with 10 different treatments (see Table 1) being sown in 10 m wide x 100 m long strips which have now been criss-crossed with the same mix of crops in 2009 before a final treatment of cereals in 2010.

A second GRDC and DAFWA supported trial has been established at Wongan Hills in the central wheatbelt to help our understanding of break crops in future farming systems in that type of environment.

### What are we measuring?

Some of the elements being measured in the DCS trials to quantify the effect of one crop on the performance of the following crop include:

- Water use;
- Disease flow,

- Yield stability;
- Weed carryover;
- Residue impact,
- Economics; and,
- Soil health.

The trial design allows for many combinations of crops to be followed by wheat in the one environment. This provides a fair comparison of the various crop sequences.

See *Southern Focus* for the second article in a DAFWA series detailing break crop case studies.



Aerial photographs of the DCS trial site.

## BREAK CROP BENEFITS INCREASING OVER TIME

According to Mark Seymour, Research Officer for DAFWA, there has been research in the past throughout WA to determine the break crop effect of lupin on sandy soils, field peas on heavy soils and canola on a range of soil types.

“Over 150 experiments have been conducted across the wheatbelt since the 1960s to determine the rotation effects of

leguminous or oilseed crops in a cereal based rotation,” says Mark.

“Most of this work has been reported in the context of a yield improvement to following wheat crop compared to a continuous cereal rotation. This can range from no effect to a 20 per cent benefit depending on the situation.

“But with the advent of no-till and the availability of more effective grass herbicides, the actual magnitude of the yield advantage has increased. For example, since 1990 wheat after lupin yields are actually larger than in trials conducted before 1990 (see Figure 1),” Mark points out.

“Nowadays farmers also have access to more effective fungicides to control both leaf and root diseases in cereals, and they routinely apply fertilisers throughout the growing season at generally higher rates (in total) than 10 years ago. Under these circumstances you might expect the yield benefit from a break crop to now be lower.

“This is one of the reasons for revisiting the crop sequence trial – to help answer the question farmers ask: “What is the best crop to sow after the last one or two?”

“The DCS trial approaches this question in a different way. In the third year we can look at the effect of 100 different crop sequence combinations leading up to the third year wheat crop,” Mark said.

**FIGURE 1: The yield response of lupin-wheat (LW) versus wheat-wheat (WW) at a range of applied nitrogen rates in the wheat year. Shown are results from numerous DAFWA rotation trial sites across the WA wheatbelt in both the period prior to, and after, 1990**

