Joys and Sorrows of No-Tillage Sowing in Western Australia

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ABSTRACT

The adoption of no-tillage in Western Australia has been a rapid revolution. The adoption was farmer driven. Much of the scientific data being presented during the time of explosive change, during the early 1990s, was negative towards no-tillage. It was the bigger systems issues and longer-term sustainable benefits that farmers observed that helped no-till to forge ahead. Information provided by, and shared among, the Western Australian No-Tillage Farmers Association’s (WANTFA) network was, and still is, an important key to the large adoption of no-tillage. The WANTFA membership is now 1400, from the 50 who started the movement in September 1992. Our group was modelled on ManDak.

BACKGROUND

CLIMATE

Southern Western Australia has a strong Mediterranean climate. The 44 million acres of land, with sufficient winter rainfall (28-35”), has a latitude similar to southern California. It has a cool winter growing season from May to October, with hot and dry summers - when annuals do not survive (see Figure 2). A typical winter day would range from 40°F to 60°F, warmer by 5° in the north. Summer maximum temperatures can reach 115°F in the northern and central regions.

Soils

The soils are mostly very infertile and sandy with little buffering capacity. About 60% of the soils are duplex, or sand over clay at 4-20 inches depth. There are large areas of deeper sands also. These duplex sands usually contain only 1-5% clay and in the natural state the soils grew Eucalyptus trees and contained almost no copper, zinc, molybdenum or phosphorus (1-5 ppm). The red loams, in the river flat systems, typically had enough nutrients to grow low-modest plant production.

Age of Agriculture

The somewhat fertile river loams were able to grow crops and pastures when first cleared of trees in the 1870s. The sandy soils were not used until in 1946 after they discovered the soils lacked trace elements. Then in a decade during the 1950s the government cleared more than a million acres a year. Now, 40 years later, 9% of this land is salt and they expect it will total 30% of the land by the year 2025. This is our crisis issue. More on this issue later. Many other crisis issues of the past in our agriculture have been solved by the widespread recent adoption of no-tillage.

Sheep and Pasture

During the hot summers merino sheep roam inefficiently in search of food and water. Their roaming loosens the dry soil and predisposes it to wind and water erosion and structural damage on heavy soils. However, sheep have been an important part of Australian farming. The sheep require fences, forages (pastures) and a dam in each paddock. Paddocks are often 150-300 acres in size and farms are often 2000-10 000 acres in size and each farm has a large shearing shed and pens for shearing and pest management.

Pastures naturally regenerate in April-May after enough rain falls and the temperature drops. This is called the break to the season. Annual germinating pastures are weeds in crops, but since there are no perennial weeds to kill (dry summers) low rates of glyphosate (120 ml/ha) often work effectively. Pastures produce a lot of nitrogen. Some cereal crops would only get 25 lbs
N/acre while canola might get 80 lbs. The cool and raining conditions after seeding make urea 4 weeks after seeding a sensible option in WA.

WHY WAS NO-TILL ADOPTED? – THE JOYS!
The massive amount of wind erosion that occurred in WA, and in particular along the south coast, in the early 1980s and early 1990s, created a fertile atmosphere for change. Farmers – and their wives – were tired of severe wind erosion and dust problems. Not to mention the loss of a very useful sandy soil that was often shallow and overlying an inhospitable sodic clay subsoil. These soils are called duplex and are not common (existent?) in North America.

Once farmers experimented with no-till they discovered lots of unexpected benefits. They could not only stop wind and water erosion, but they could seed into drier soil, they had improved earthworm activity and yields were not decreased (when put into the right part of the rotation). Farmers also found they could spend more time with their families at seeding, trafficability was improved, they could sell excess equipment, they had more seeding management flexibility and they found their over-all agronomic knowledge improved. This was because mistakes are more obvious with no-till and better monitoring was essential and more possible with no-tillage.

Farmers also discovered, within a few years, that weeds could be more effectively controlled if they were left on the soil's surface with no-tillage. This was particularly so when using trifluralin with knife-points on wide row spacings (9-11”). In fact, all soil active herbicides were more effective in the no-till systems, compared to full cultivation systems. With the widespread severity of herbicide resistance to many herbicides, particularly to the fops, dim and SUs, this better weed control has been a driving force for no-till adoption in recent years.

WHAT ARE THE CURRENT NO-TILL ISSUES?
We are at a time of continued great change in our cropping systems in Western Australia. Some of these include; the diminishing role of sheep over the last 10 years (poor wool prices), trying to find more diverse and appropriate rotations, and trying to survive with increasing herbicide resistance.

The fading of sheep has created a niche for other options. Without sheep there have been improved crop grain yields from retaining stubble and better time of sowing and not allowing sheep to spread weeds over the whole farm. Conversely, not having pasture in the farming system removes grazing as a management tool for herbicide resistant weeds.

SORROWS OF NO-TILLAGE SOWING
Herbicide resistance
Increasing reports of glyphosate resistant weeds is the biggest threat to no-tillage seeding. Without an effective and cheap broad spectrum burn-down (knockdown) herbicide, and tillage (with all the damage it does) – how else can we no-till? Most of our problem weeds have demonstrated resistance to most herbicide groups. There is glyphosate resistance in two confirmed cases in Australia, and several more are highly suspected. At least two glyphosate resistant weed populations have been identified in California, and Malaysia has recently reported several populations of glyphosate resistant weeds. We desperately need another glyphosate herbicide soon.

A strategy developed in Western Australia to extend the life of glyphosate is the “double knock” technique with Spray•Seed™ (paraquat 135 g a.i/l + diquat 115 g a.i/l) use. Most no-tillage farmers now apply Spray•Seed™ onto weeds that are still dying from glyphosate uptake. The Spray•Seed™ is applied within 1-10 days of the glyphosate application. This double knock technique has become the normal practice with most no-tillage farmers in Western Australia over the last ten years. Apart from delaying the occurrence of knockdown resistance, the technique also ensures quicker weed root release, improves herbicide mix options, can achieve an extra kill of new weeds, ensures barer ground for longer and can clean up areas that may have been missed with the first knockdown.

Farmers have been making significant changes to their weed management strategies over the last 10 years. Resistance to all herbicides is well understood in our farming communities. Farmers are swathing, manuring, cutting hay, using chaff carts, mixing up rotations, changing seeding time, burning header rows, adopting no-till, using the Chaff Top, growing short season crops and ensuring...
a weed emergence flush occurs before spraying and then
seeding with minimal disturbance. Some have even
brought sheep back in (though the sheep may not be profitable
alone) and many are experimenting with warmer season crops.

It is clear that we must develop more diverse ways of
killing all weeds. In Western Australia, this is particularly
important for ryegrass and radish. No-tillage has provided
significant biological weed management tools – with
allopathy and surface placement rotting and predation
(by ants, in particular). However, these must be compli-
mented with other physical tools, particularly those
tools that are still to be developed, like crushing the seed.

Insects and diseases
Obviously these pest problems are best managed with
diverse crop-type rotations – as Dwayne Beck would
say. But the search for finding these profitable and
diverse rotations in our environment is very challenging
and has only recently begun in earnest. This search for
diversity is ridiculed by most experienced researchers.
The other option, which many researchers keep coming
back to is – plough and burn! Neither of these excite many
WANTFA members, who are keen to go forward – not
back to the problems this approach offers.

There are only two crop types used in WA; they are
cool season grasses and cool season broadleaves. Three
years of farmer experiments suggest that sunflowers and
grain sorghum may have some potential, with likely poor
yields. Our hot and dry weather soon after seeding in
September in sandy soils (holding only 10% moisture)
evidence is for scepticism of their potential.

However, without this desperately needed diversity
our cropping systems need modest pesticide inputs
(low compared to European agriculture). Our hot-dry
summers do not kill many crop disease problems, while
our long-cool winters give many diseases ample time to
build up and move on the wind throughout the state.

Most of our pests are protected by stubble retention
and are worse with no-tillage with our limited cool
season crop diversity. Some of these pests include
false wireworm, slugs, red legged earth mite, various grubs,
snails (in patches of alkaline soils), mice, Rutherglen bug,
septoria in wheat, various barley leaf diseases, blackleg
in canola, Ascochyta in chickpeas, blackspot in peas. It
is a rare plant pathologist who does not recommend
burning and tillage to manage these problems.

Too few progressive researchers
While no-till has been rapidly adopted by farmers,
many researchers are still negative about no-till.
This has restricted the amount of useful research that
has been done. Many researchers are very quick to say
‘we told you so’ when problems emerge. It would be great
if they said ‘let’s push on and refine the system to cope
with the new challenges’. One thing is for sure, the farmers
are not keen to go back!

It makes water repellence worse
With very little surface area in our sands, they easily become
coated with xowy material from retained organic matter.
No-tillage makes this problem worse and now many
farmers are applying 250 t/ha of clay on the surface and
mixing it in to raise the clay levels to 5%. Water repel-
lient soils severely exacerbate crop production – reducing
yields by 20–60%

BRIEF NO-TILL HISTORY IN WA
Interestingly the Agricultural Department’s early trial work
showed lower yields with no-till. The advent of severe wind
erosion, fops, better legume crops, clean break crops, tungsten

SEEDING MACHINES
Which type of no-till machine farmers should buy is not
clear cut. Some environments favour zero-till discs
while others no-till knife-points. Press wheels are always
favoured. Trash flow is best with the discs and they ride
over rocks better. The wear rates on either machine type
are high and changing tips every 300-500 acres occurs
often in Australia. Tungsten carbide tips are now
common. Australian farmers can zero till with some very
cheap machines although many of the expensive
Canadian seeders are commonly bought.

SUMMER MANAGEMENT ISSUES
The 2-3 thunderstorms that might occur during summer
drop some rain before the true break and this will
allow weeds and insects to grow. Some of these will not
be killed prior to the break, and if these weeds are not
quickly controlled are hard to kill before seeding. Their growth
allows insects to grow – which damage emerging crops.
Without early weed control no-till can fail; with it, the
extra moisture conserved allows early crop establishment,
but increases the threat of the rising groundwater.

CONCLUSIONS
Farmers continue to be enthusiastic about the benefits
of no-till. This is despite many of the pest manage-
ment issues that have arrived since no-till. The
management flexibilities that no-till offers and the
sharpening of farmers’ skills has many farmers realising
the power of no-till to improve their agronomic perfor-
ance and to understand their systems better.

There is a continuing need for farmers to take
control of their own agronomic destiny. Researchers tend
not to be leaders, but followers, and the lag phase is often
very frustrating – especially when you are on the edge.
Keep up your good work, and on behalf of WANTFA President Mr Geoffrey Marshall and myself, many thanks for your willingness to share freely with us! All the best!

ABOUT THE AUTHOR

Bill grew up on a wind erosion stricken farm at Jerramungup (where there are some of the most severe erosive winds in world agriculture) on very sandy surface soil. He obtained a B. Ag. Sci. from the University of Western Australia in 1985. He worked as a researcher/extension worker on a project called ‘minimum tillage for wind erodible sandplain soils’ from the Jerramungup Department of Agriculture from 1985-1987 before becoming general extension officer at Esperance and Jerramungup from 1987-1990 and 1992-1995 (working on a Masters degree in 1990-91). In 1996 he had a one year job exchange to Canada where he worked closely with the big farmer group ‘Manitoba North Dakota Zero Tillage Farmers Association’ and co-edited their book called ‘Advancing the Art of Zero-Tillage’. Since returning in April 1997, he has been employed by the Western Australian No-Tillage Farmers Association (WANTFA) as their Scientific Officer.

IF YOU HAVE ANY ENQUIRIES REGARDING THE CONTENT OF THIS ARTICLE, PLEASE CONTACT:

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