AUSPLOW
Digging deep for every farmer.
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# SOIL HEALTH AN AGENDA ITEM FOR BETTER BROADACRE CROPS

BY JOHN RYAN AM

THERE'S AN IMPORTANT CONTEXT TO THE BIOFURROW™ HYPOTHESIS OF NEAR-ROW SOWING, WHICH I HAVE BEEN DISCUSSING FOR THE PAST TWO YEARS.

And that is, soil health.

In a perfect world, to grow healthy crops with high hectolitre weight and high protein, the soil in which the plants are growing, must be aggregated with the presence of air and moisture and, most importantly, beneficial bacteria.

The starting point to achieve this, for broadacre cropping in Australia, I believe, has been the introduction of the DBS precision seeder to start the process of building healthy soils.

I designed the DBS, with the three-slot system, to create an ideal environment, initially for seed germination and then for healthy plant growth throughout the growing season. And this has been vindicated by the adoption of the DBS throughout Australia.

Ausplow is now the nation's leading manufacturer of precision broadacre seeding bars.

In the early developmental stages of the DBS, the emphasis was on precision seed placement, while breaking hard pans, with the added benefit of water harvesting. This continues to be the case as we refine the DBS with subtle changes to improve its performance.

The key to establishing the optimum environment for the seed is the DBS three-slot system which provides the seed with moisture and air – the starting point to building soil structure.

And during the past 25 years, DBS owners report to us of positive structural changes to their soils.

So ideal soil environments are being created for growing crops but there remains limitations to the type of crop yields and quality we should be expecting from such soils.

I believe those limitations are directly correlated with soil biology, with research work done by our consultant Dr Margaret Roper opening the door to new thoughts on how to grow high-yielding and quality crops.

This has now become a major research and development focus for our company aligned with continued R&D involving the DBS and liquid-ready Multistream air seeder.

The genesis of this focus on soil is the near-row sowing BioFurrow™ hypothesis.

It is revolutionary because it focuses on soil biology as the main engine for crop growth with declining emphasis on synthetic fertilisers and chemicals.

It will be a process for farmers wanting to adopt the BioFurrow system, but the main tool already is being used, ie, the DBS.

My view is that conventional broadacre agriculture throughout the world is being challenged to a point where change must occur.

Firstly, farmers are being challenged with increasing costs not matched by increasing higher prices for their crops.

Secondly, United States farmers are perhaps the proverbial canary in the coal mine, as they battle with increasingly unhealthy soils which, ironically because of their quality, have masked the problems of dying soil biology, triggered by more than 70 years of synthetic nutrition and chemical applications and continued tillage, despite the growth of no-till and vertical till.

This subject has been an elephant in the room for agriculture for too long.

It is why I believe we all need to assess the need for change and whether to pay attention to a growing body of scientific work which in the past 10 years firmly points to soil biology as the way to go forward.

# IMPROVE SOIL HEALTH FOR MORE PROFITS

BY JOHN RYAN AM

## A LOT OF MY DISCUSSIONS ABOUT CROP ESTABLISHMENT WITH FARMERS THESE DAYS RELATES TO QUESTIONS.

And I must admit the more I hear and read about crop establishment, the more questions I have.

And it is related to our DBS precision seeder and our Multistream air seeder, with growing conversations, particularly in the United States, related to soil biology.

Over the past 12 months I've read books by Australian farmers Charles Massey (Call of the Reed Warbler) and Matt Evans (SOIL), New Zealand farmer Nicole Masters (For the Love of Soil), US consultant and physician Dr Arden Andersen (The Anatomy of Life and Energy in the Soil) and US agronomist and soil health pioneer Jon Stika (A Soil Owner's Manual).

Additionally, I have listened to many podcasts by another US agronomist John Kempf, who is a keen advocate of learning about soil biology.

Interestingly from all the information I've gleaned, everybody is on the same page in regards to ways to improve soil health and grow better crops.

And there are some stark observations from the above authors about the way we crop today.

Overuse of synthetic nitrogen (and tillage in many countries), is seen as the main culprit destroying soil biology, along with chemical applications.

Incidentally, this has been recognised by the Grains Research and Development Corporation (GRDC).

This 2020 GRDC note states:

Over recent decades cropping rotations have intensified, pasture and livestock production have declined, and N fertiliser requirements have increased.

Of concern is the fact that most cropping systems in this recent phase have been effectively mining soil organic matter and N, because the N removed in grain is not being replaced by N in fertilisers or fixed by legumes in rotation.

Consequently, cereal protein levels are often low and yields are below water-limited yield potential.

According to Nicole Masters, the high use of soluble N creates an entropic (uncertain or disordered) system with decreasing returns due to the breakdown of soil carbon and humus.

She goes on: "Microbial communities are altered with a decline in beneficial fungi and free-living N-fixers (bacteria) which process nitrogen into plant-available nitrate.

"This creates conditions for compaction and limits root growth.

"High nitrogen applications reduce plant sugar content and the amount of carbon being sent out to the roots, to feed beneficial bacteria."

Nicole also says there is a trap in relying on visual observations of plants such as leaf yellowing.

She says the main assumption is that the plant is nitrogen-deficient and the response is to add more nitrogen.

"But the yellowing could relate to iron (in younger leaves), potassium, magnesium, molybdenum, sulphur, manganese or zinc or other environmental factors," Nicole said. "Don't rely on plant clues for more nitrogen applications."

Dr Andersen is straight to the point describing nitrogen as the "most over-used, misused and abused element along with potassium".

"The air is about 78 per cent nitrogen," he said. "Soil plants and bacteria have the capability of extracting much of their N needs from the air if they are allowed to do so (such as in an environment where beneficial bacteria thrive).

Dr Andersen also makes a point of the correlation between carbon and nitrogen.

He says carbon is the primary buffer in the biological world. Without carbon there is no stabilisation of nutrients.

Carbon deficiency results in a carbon dioxide deficiency which causes a carbohydrate and oxygen deficiency, harming the plant's primary functions.

This is turn results in decreased aerobic microbial life, reduction of the carbon cycle and finally sterile soil.

When carbon is deficient (such as in beneficial bacteria-deficient soils), nitrogens can form "nitrogen-funny" proteins such as nitrites and nitrous oxides, which are always toxic to biological life.

Dr Andersen says carbon is a key element for the formation of desirable soil structure, tilth and water-holding capacity.

The right carbon is biologically active as opposed to a carbon compound (such as a diamond) which is not.

According to Matt Evans, artificial nitrogen decreases microbial activity.

This weakens the soil because of a decrease in the glomus species of mycorrhizae.

Glomus is a genus of arbuscular mycorrhizal (AM) fungi, and all species ("bugs") form symbiotic relationships with plant roots to exchange sugars (plant roots) and nutrients (so-called bugs feeding the roots).

Matt says artificial nitrogen promotes less soil carbon-fixing because there's less "bugs" to do that work.

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But there's no suggestion here of throwing the baby (N) out with the bath water (poor soil).

According to Jon Stika, the "bath water" can be described as dysfunctional soil mostly devoid of beneficial bacteria.

From his observations and research, he believes no-till is only half the story, because it hasn't improved the soil to the extent of it being fully functional with active bacteria.

He is not blaming anybody for what is now a system of agriculture, growing crops in (a majority of) dysfunctional soils.

"Nutrient trial data throughout the world has basically been collected from crops growing in dysfunctional soils, 'proving' the need for more N,P,K and other nutrients," he said.

"This enables dysfunctional soil to work but it's a (costly) cycle that does little to enhance an active bacterial population in the soil."

John Kempf emphasises the benefits of a functional soil saying, "we know that biology can get 100 per cent of the nitrogen a crop requires".

The way forward, as I see it, for those DBS owners interested in near-row sowing, is to start doing trials.

The DBS is the important tool in the tool box but every owner must discover what other tools can play a complementary role in building soil structure and hence, functional soils.

Change will be slow but it will happen, as already witnessed by the management practices of several DBS owners.

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# HOW THE DBS ACTUALLY WORKS IN THE SOIL

BY JOHN RYAN AM

## IT HAS BEEN MORE THAN 30 YEARS SINCE I DESIGNED THE DBS PRECISION SEEDER.

My aim was to improve better crop establishment while improving soil health.

And while we have seen many technological advances over the past three decades, I really haven't made many changes to my original design.

What was achieved with the first DBS remains the same today.

It started with a narrow digging blade having a reverse digging angle which required more pulling power.

This was done intentionally to create a bursting action of soil particles, with space for roots to grow into and to hold air and water, therefore creating an environment for healthy root growth.

Precision seed depth was achieved by parallelogram linkage, embracing the tine and covering wheel.

It was called a 'press wheel' in the early 1990s but I believe 'covering' is a more appropriate term because it follows a closing tool, which forms a firm base to place seed onto.

The rolling action of the covering wheel causes soil fines to cover seed, while forming a water-harvesting furrow.

The covering wheel has a light ground pressure so as not to compact soil and not close air and water voids.

The soil fines covering the seed are made by the closing tool shaking soil particles from plant roots (stubble and even weeds), and these fines become the building blocks of soil structure as they move during the plant's growth.

They associate with root hairs and organic material as complex biological processes create microscopic fungi, eventually leading to what we know as organic carbon.

Once this soil structure is in place, the environment created by the DBS becomes a virtual bucket, capable of holding moisture *(Illustration 1)*, whether that be from rain, water vapour (relative humidity in the soil) or from liquid fertilisers.

The minimum tillage effect of the knife blade retains all plant roots in the soil.

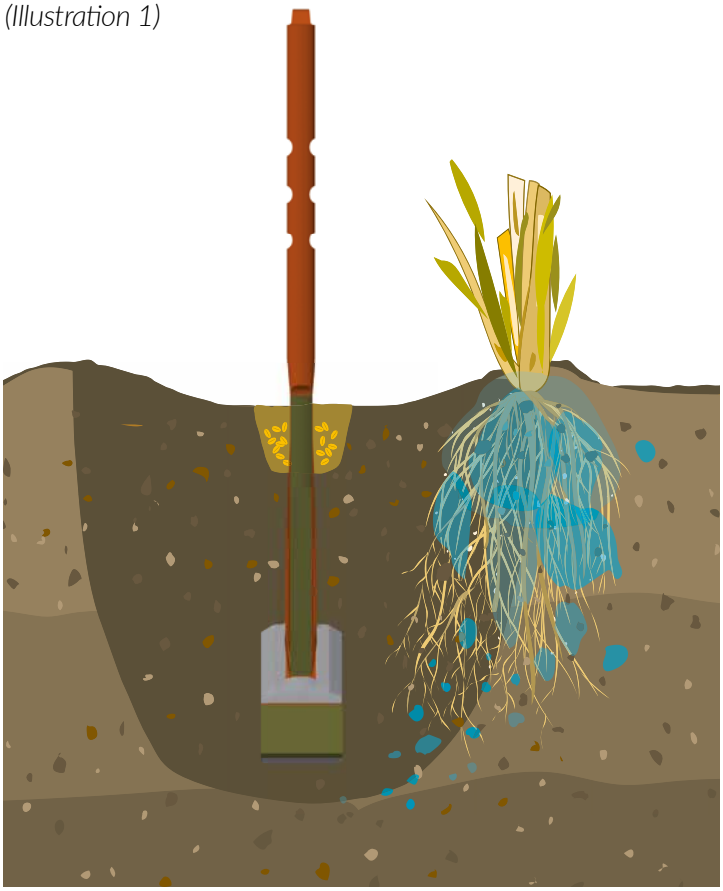
I would recommend using coulters *(Illustration 2)* on our precision seeders to further enhance this process to remove any stubble which may affect seed germination.

Roots being left in the soil to decay provide pathways for water run-off and air to enter creating an environment for microbes to colonise.

This is the crux of our BioFurrow™ hypothesis.

The non-cultivated inter-row remains firm and dry reducing weed growth, giving good trafficability, while water run-off means that the furrow receives an accumulation of water essential in dry years with low rainfall events – even from heavy dews.

*(Illustration 1)*



# NEW CHISEL DIGGING TOOL FOR DBS

## AUSPLOW HAS DEVELOPED A NEW DIGGING BLADE.

It has been designed with a low digging angle and equipped with a large tungsten tile for long-life digging.

It also uses a taper lock attachment to the original digging blade with a low-cost replacement.

The low angle of the chisel blade requires lower pulling power and lifts soil upwards in a 'vee' form with minimum disturbance of plant roots.

In operation, the blade 'pulsates' backwards and forwards in a chisel-type action, further reducing pulling power.

Stubble is easily shedded around the tine because of new hydraulic circuitry – each tine is inter-connected through each jump cylinder.

If an obstruction is encountered, a master controller allows the tine to ride over an obstruction (rock or stump) rather than digging into it.

The master control automatically resets allowing work to continue.

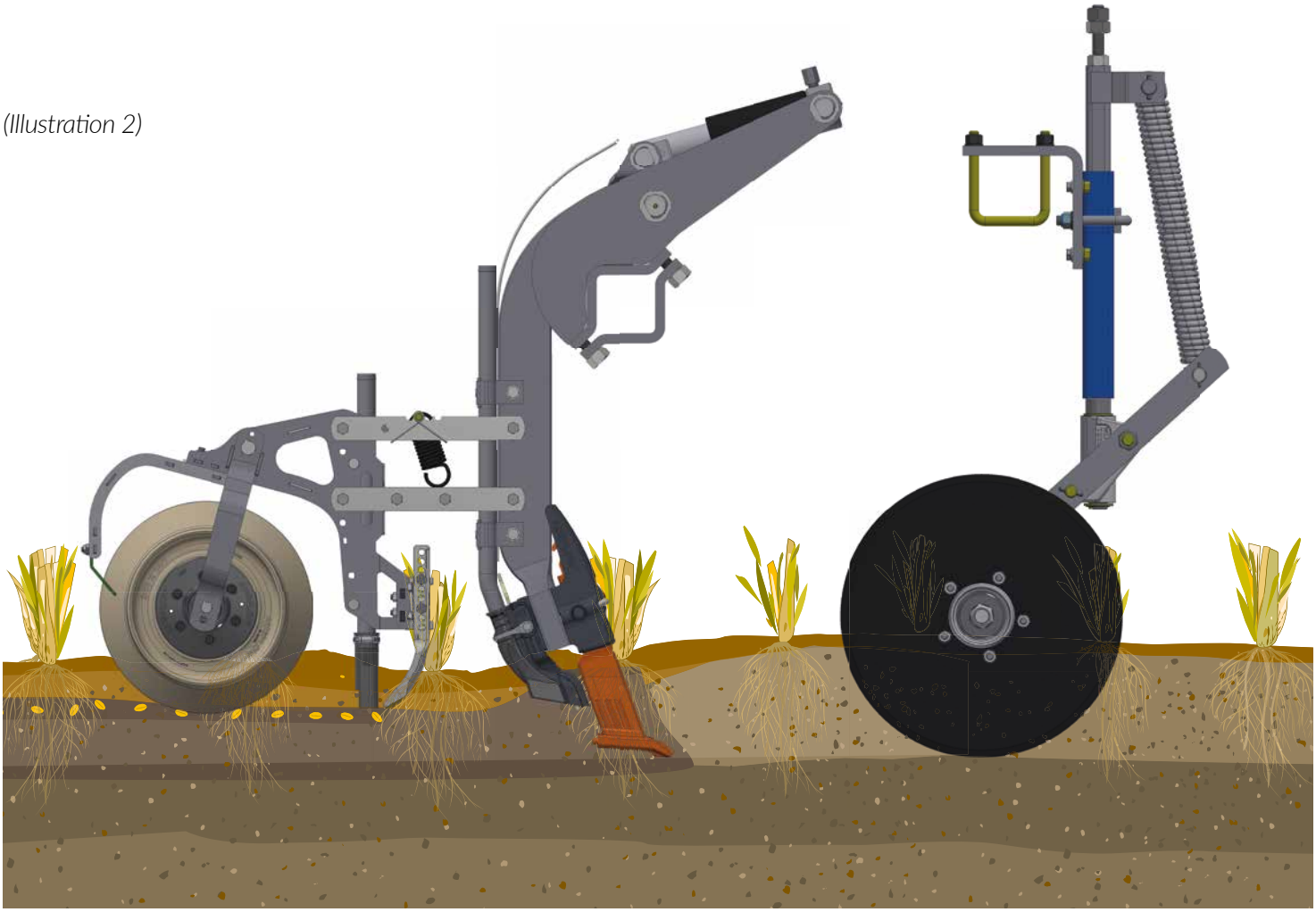
Importantly, the blade does not drag but easily re-enters into its original digging position.

This all occurs because of the unique DBS tine geometry.

The low digging angle of the chisel blade has the effect of lifting soil upwards and loosening the soil particularly in wet sowing conditions.

The new digging tool remains under evaluation as part of Ausplow's research and development program.

*(Illustration 2)*



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