Biological Farming Roundtable Notes 30th April 2015

Aim

The Aim of the Biological Farming Roundtable is to use papers/articles by leading biological thinkers to initiate discussion and to help each other learn and apply the information on farm.

This Biological Roundtable is based on Dr Christine Jones' article Nitrogen: The Double Edged Sword.

The History

Farming has changed – inorganic N was created during the Industrial Revolution and farmers began to use it on a mass scale during the Green Revolution.

Industrial Revolution: 

The transition from hand production methods to machine and chemical manufacturing. (1760 to 1840).

Green Revolution:  Representing increased agricultural production worldwide. Using methods such as high yielding varieties of cereal grains, expansion of irrigation infrastructure, synthetic fertilisers and pesticides on farm. (1940 to 1960).

Harber Bosch Method of manufacturing Urea was developed in the early 1900's. A significant connection was made that the Industrial Revolution really lead to the Green Revolution. The main point was that agriculture changed because of these revolutions. I wonder if we could be embarking on the **Regenerative Revolution?**

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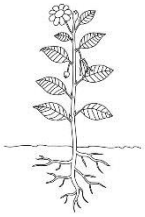
The Basic Science

The Green Revolution, in particular the application of high rates of inorganic N and P in agriculture has had many unintended effects.



What have been some of these effects?

- Plants are being fed inorganic Nitrogen (N) from the top by the grower/farmer – impacting on the plants motivation/need to interact with the biology and the soil to find biologically fixed soil N. The biological processes become less active. The microbes have no ecosystem to thrive in – less food for them, hence unable to produce soil N.

- When plants are fed inorganic N from the top, the process of photosynthesis is inhibited. Photosynthesis is the pathway that carbon is built in soils. When plant roots give sugars from the photosynthetic process in the form of plant exudates, the microbes in the soil are able to convert this into carbon/organic matter/top soil. When inorganic N is applied, there is a reduced liquid carbon pathway to the plant, leading to a reduced ability to build carbon/topsoil/organic matter. The result is degrading infertile soils.

- Once a plant is fed inorganic N it expects/ becomes dependent on this source to be fed again. This results in an oversimplification of fertilisation resulting in unnecessary dollars spent on the plant and disrupting the holistic balance of microbes, trace minerals, nutrients and carbon in the soil. Unnecessary money is therefore spent on fertilisation which means reduced profits to farmers and increased costs of food to the consumer.

- Signalling/communication between the plant root and the microbes is reduced. When a plant reduces photosynthetic efficiency (less sugars being produced) it reduces the amount of exudates (sugars) being 'traded' with the microbes for nutrients. This is a symbiotic relationship between plant roots and microbes where food is given to

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microbes in return for providing the plant with the nutrients they require. While humans can try to measure this, only the plant knows what nutrients it needs and when. When plants reduce the sugars available to microbes there will be reduced microbial activity which will result in plants receiving an unbalanced supply of nutrients – similar to what we are seeing with foods that are being eaten by humans with a lower nutrient density. We are eating what we are growing. Many of our diseases today can be attributed to have a low nutritional base, e.g. cancer and cardiovascular disease.

- Excess inorganic Nitrogen is not stable in the soil (highly leachable). What the plant does not use, gets leached into the atmosphere and waterways. This effects the whole ecosystem. All parts of the landscape and agriculture are linked. E.g. birds, insects, water ways etc.

- Reduced microbial life in the soil leads to reduced ability for soils to aggregate, (create small and larger lumps of soil that hold organic matter, microbes, water, nutrients and allow the soil to breath, hold water, allow root systems to grow down deep into the soil, filter water). Soils that are not aggregating become compact, anaerobic, cannot hold water and have shallow root systems.

- Less photosynthesis leads to thinner cell walls due to lack of sugars. This results in sick plants susceptible to disease, pest infestation, frost and drought.

- When high amounts of inorganic fertiliser are added, other nutrients become out of balance and become unavailable – nutrient lock up. When ratios of mineral/nutrients are incorrect in the soil, conditions are often favourable to weeds/insects.

Why does high inorganic N inputs lead to the depletion of soil carbon?

This was covered in the discussion above.

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Inorganic N reduces the ability of the plant to photosynthesise efficiently reducing the amount of plant exudates. Plant exudates are the starting blocks to microbes building organic carbon in the soil.

What is the difference between stable and unstable forms of carbon?

- Stable forms of Carbon are built through plant exudates – the liquid carbon pathway.
- The surface of the soil generally referred to as 0 to 10cm contains the highest levels of short-chain carbon. This is very important for the soil food web.
- We are looking to store carbon deeper in the soil – the deeper the carbon the more humified. The aim is to continue to build carbon rich topsoil downwards into the soil.

The three types of plant available N was discussed.

- N that is readily available from organic matter and microbial pools.
- N that is fixed from the atmosphere by microbes.
- Soil mineral N (ammonium and nitrate).
- Amine was also mentioned. It was noted that there are many different forms of N, different plants take up different forms. Very difficult to get your head around all of them!

Some Answers

What's the key to keeping the N in the soil and available to plants?

- Microbes
- Soil Aggregates
- Green plants
- Organic Matter/Carbon
- All parts of the process are important/dependent on each other.

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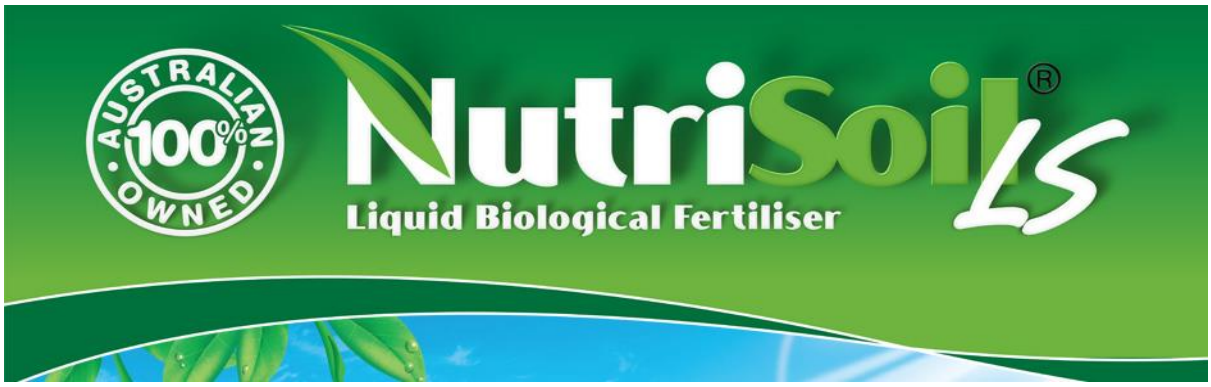

How can we increase plant and farms photosynthetic efficiency and capacity?

Capacity

- Increase the amount of green plants.
- Select plant species according to seasonal germination and suitability for region/environment. Need to research what's working in similar situations.
- Leave summer green weeds in longer – less herbicide.
- Direct drill into crops that animals e.g. sheep have eaten down stubble and fertilised with manure.
- Avoid glyphosate where possible.
- Don't be concerned with some weeds. Some are annual and will not stay on.

Efficiency

- Use biological inputs. Compost tea, Fish – feeds fungi – Nutrisoil (Vermi-liquid– feeds both fungi, microbes and the plant.) Milk, trace minerals.
- Increase Mychorrhizal Fungi which transfer energy in the form of liquid carbon to the N fixers (N fixing bacteria) as well as biologically fixed N to plants. NutriSoil has results of increasing Mychorrhizal Fungi by up to 70%, Fish is also another source.
- Reduce synthetic fertilisers as they reduce the plants ability to photosynthesize.
- Planned grazing.

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Christine Jones provides four principles of Regenerative Agriculture.

1. **Maintenance of year round living cover**

It was noted that this is very difficult to do when there have been a number of years of drought and windy conditions where top soil is being blown away.

Transitioning actions in these conditions could be:

- Accept weeds as groundcover as they are the green plants in drought conditions.
- Sow a diversity of Plant species that survive/thrive in seasons - not monocultures.
- Feed bio stimulant fertilisers if there are any growing opportunities
- Reduced use of herbicides.
- No till practices.
- Use sacrifice paddocks to feed stock hay and rest paddocks

2. **Provide support for the microbial bridge to enhance the flow of carbon from plants to soil**

- Aeration
- Create a food source for microbes – green plants, litter, mulching – encourages moisture.
- Reduce chemical inputs e.g. high analysis N and P.
- Reduce disc tillage.

3. **Promote plant and microbial diversity**

- Plant a diversity of plants.

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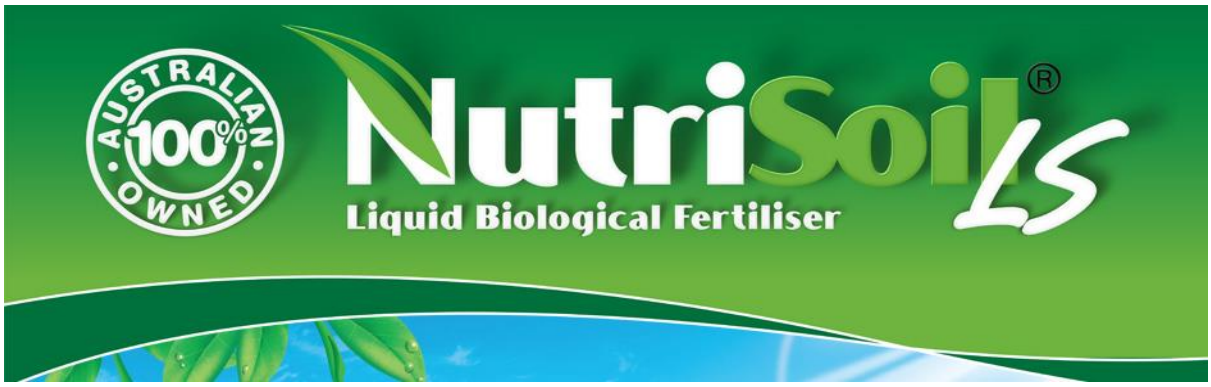

- Feeding the microbes with a bio-stimulant will lead to an ecosystem in the soil which will germinate any dormant seeds thus increasing plant diversity in pastures.
- Feed all microbes not just one type – e.g. fish feeds only fungi, NutriSoil (vermiliquid feeds all microbes as well as fungi).
- Reduce use of synthetic Phosphorous fertilisers. Pastures may grow plants that favour phosphorous reducing the diversity of species in plants, microbes and beneficial insects.

4. **Land responds positively to the presence of animals provided the management is appropriate**
    - Animals fertilise the soil with manure.
    - Sheep are very good for eating stubble and weeds while manuring/fertilising for crop preparation – An alternative to burning stubble.
    - Animals stimulate the biology.
    - Use rotational grazing as well as event grazing. E.g. some rotational grazing can be inefficient, combining with mob grazing and varying the events on the paddock help.
    - Use sacrifice paddocks to feed stock hay so other paddocks can rest.

Some summary points from the day

- Keep trialling, but stick to programs to ensure that full response is considered. E.g. One application of NutriSoil will not show the full potential of the product. Changes begin to appear slowly e.g. change in colour, growth of roots, increase of earthworms, germination of seeds on soil, reduced insect attack, increase in organic matter, change in soil colour, increase in ability to hold water. It can take three to eight years at times to transition to a healthy soil.

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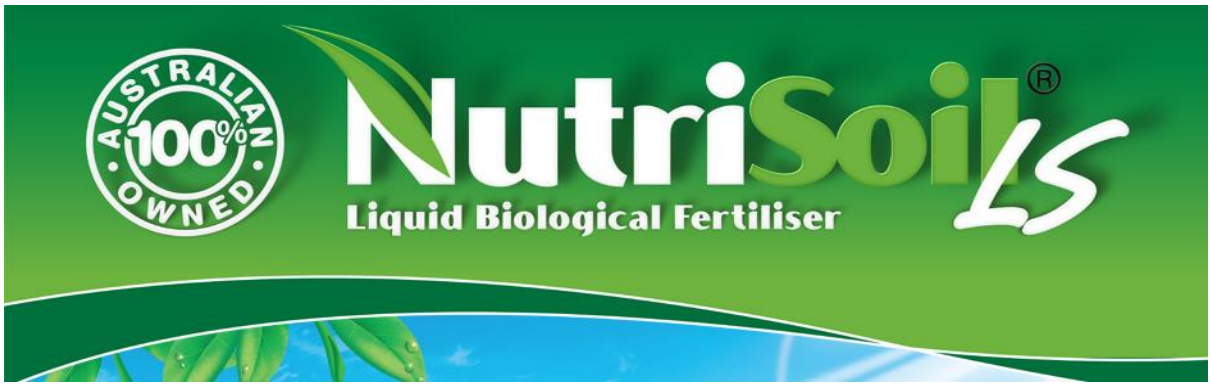

- Ecology = Economy. Crops are being harvested at similar yields with huge savings on fertilisers. Cost per unit of output is being drastically reduced and farmers are making better profit margins and regenerating their soils.

- The financial risks of a conventional crop are very high. Cropping biologically reduces this risk and is a much more sustainable farming system. Soils are being regenerated and not degraded – a future and a joy is put back into farming.

- Using an amino acid form of fertiliser can make minerals applied available up to 10 – 100 times more. E.g. Milk or NutriSoil is in these forms as they have come from an animal, there are a number of other amino acid forms that a plant needs.

- Amino acids are linked to the formation of proteins such as chlorophyll, hormones and enzymes. Foregoing an amino acid to form a protein leads to incomplete protein levels. We are seeing this in cereal grains today. Biologically grown grain as opposed to conventionally grown grain, are being recorded to have higher complete protein scores. Research is indicating that one part per million can be making a significant impact on food quality and human health.

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