

Biological Farming : A Practical Guide

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Background



- Trained as a Veterinarian
- My husband and I have been farming for 22 years on the shores Lake Alexandrina and Coorong
- Three daughters



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Farm details

- *Total area 2400 ha (7000 acres)*
- *120 ha irrigated pasture-pivot and flood*
- *2000 ha dry-land cropping and pasture*
- *Dairy, Beef & Cropping*
- *Ave rainfall 400mm*



Farming Challenges

- Pasture persistence
- Increasing weeds, pests and diseases
- Increasing inputs
- Declining responses
- Declining profitability
- 'MORE ON' farming



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Conventional Farming

- Reactive to symptoms rather than the causes
- Relies heavily on increasing rates of fertilizers, herbicides, fungicides and pesticides
- Does NOT considers effect chemicals have on the soil microbiology
- Diminishing terms of trade



Biological Farming

- Biological Farming works on preventing problems by understanding causes
- Soil has physical, chemical and biological parameters IT IS THE HEART of BF
- Aims to restore balance of soil parameters
- Soil working at optimum levels will have reduced weeds, diseases and pests
- Ultimate goal is nutrient dense food



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Why look at Biological Farming?

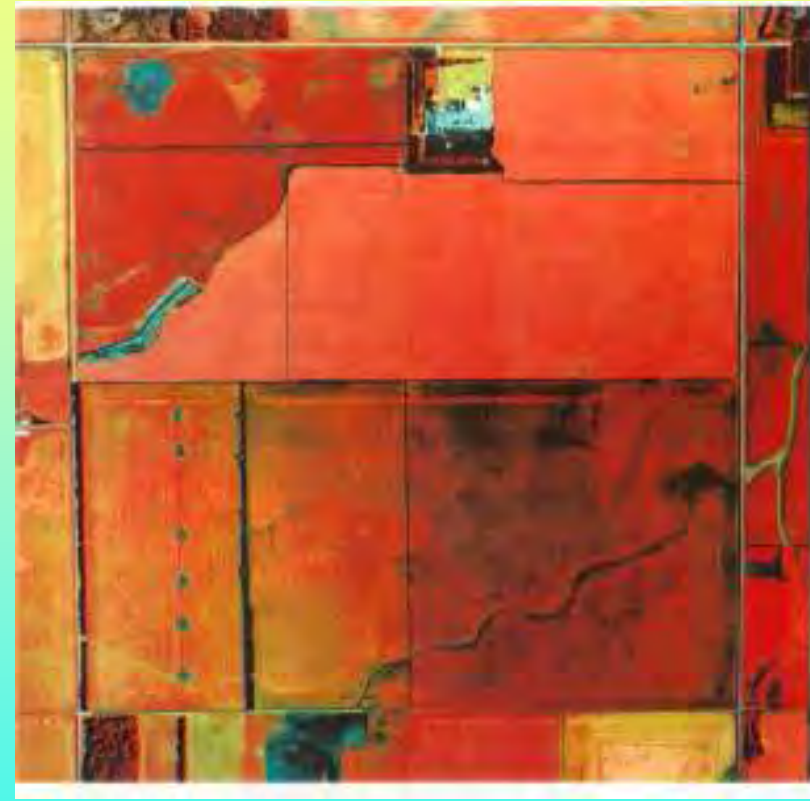
- Minerals have decreased in food
- BF has increased nutrient content
- High levels of agricultural residues in school children.
- BF uses less or none ag.chemicals
- Choice found 25% Fruit & Vegetables with agricultural residues. *Advertiser Sept 07.*
- Reports that glyphosate are linked to juvenile leukemia



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Conventional vs Biological

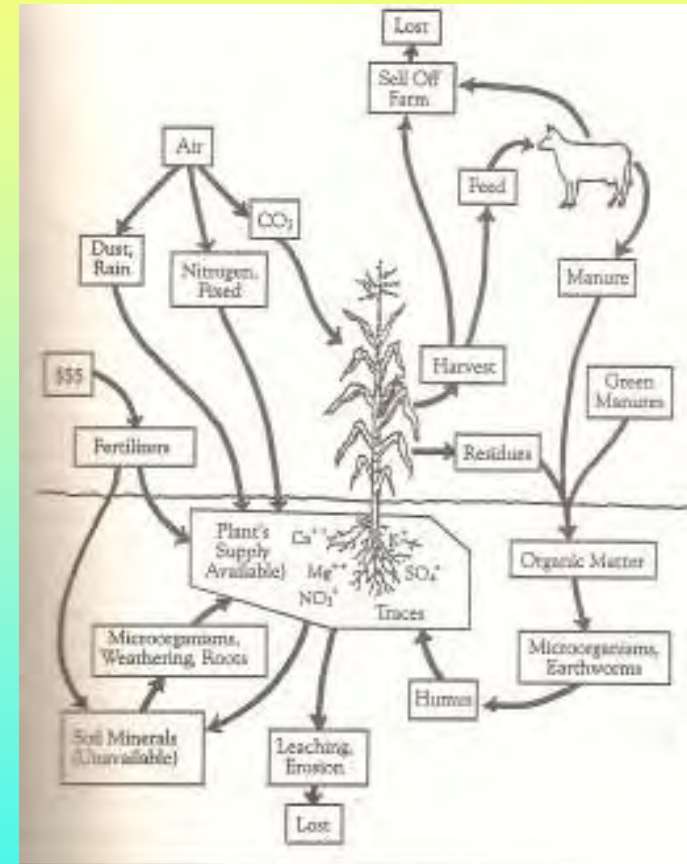


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Biological Agriculture

- Soil Food Web act as the digestive system for plants
- Inorganic fertilizer, ag chemicals, tillage have negative effect on SFW
- Ideally 80% nutrients from air



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Sidney Myer
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Physical

**Organic
Matter**

5%

Air

25%

Minerals

45%

Water

25%



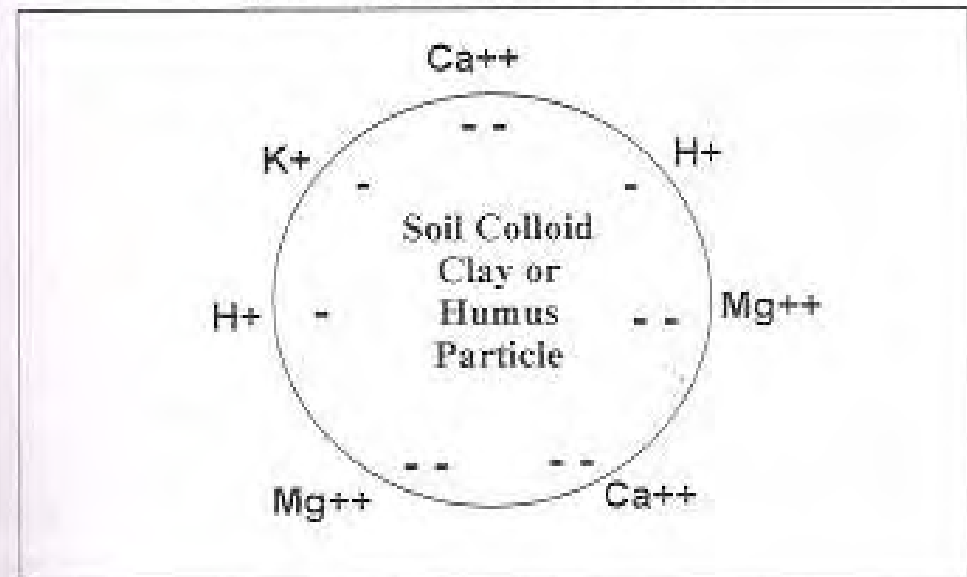
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Chemical

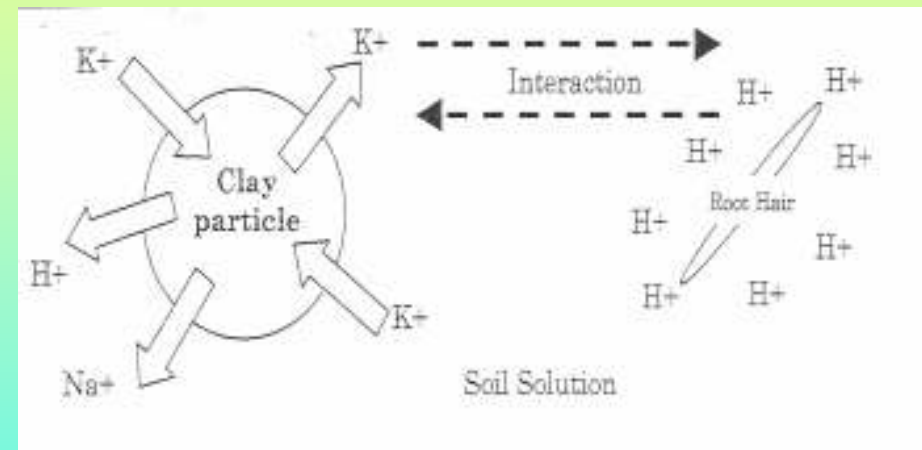
- Elemental balance
- Not arithmetical totals
- Cation Exchange Capacity
- Cations must be replaced on the anion if removed

Diagram to Illustrate Cation Attraction to Negatively Charged Soil Particle

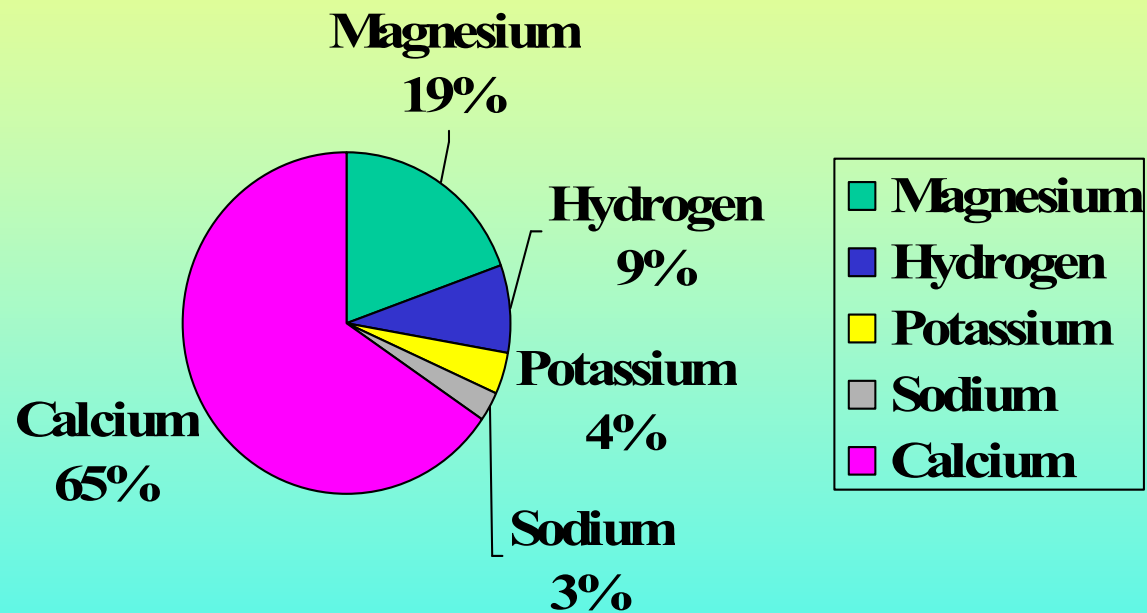


Chemical cont.

- pH is purely a measure of Hydrogen
- Hydrogen is plants 'money'
- hydrogen is exchanged for other positive ions



Desired soil elements

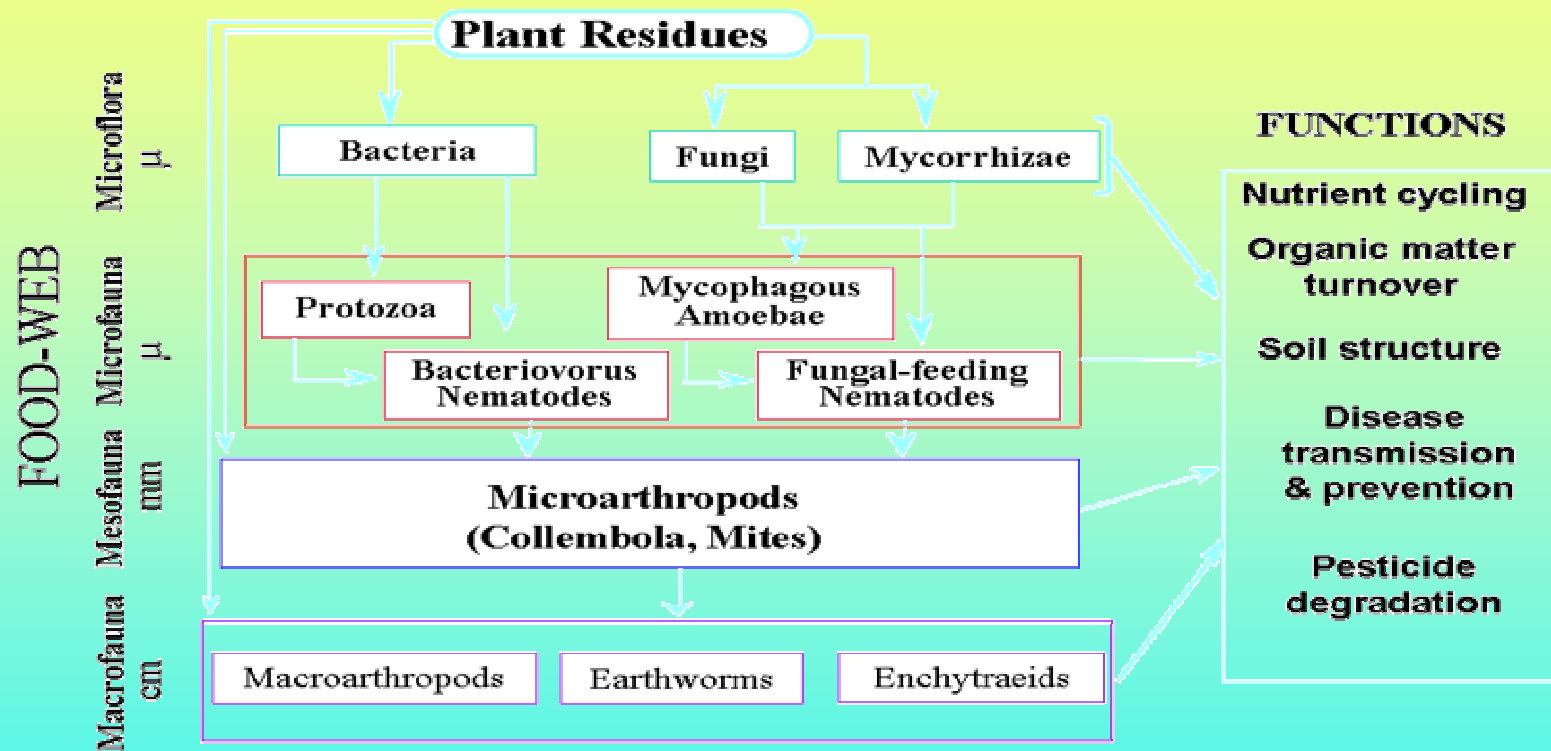


Cation Exchange Capacity

- When minerals are in correct ratios the soil don't stick



Biological



(Roper and Gupta, 1995)



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Monitor so you can Manage

- Scientific quantification and Qualification
- Objective
- Subjective
- Pool all data and look at whole picture
- Diagnosis
- Treatment



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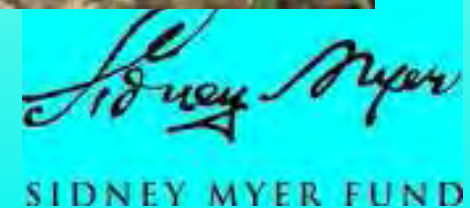


See what you are looking at !

Phillip Callahan



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Physical Measurements

- Penetrometer
- Digging



Measuring Physical content

- Smell
- Touch
- Colour
- Texture



Chemical Measurement

- Key elements
- Ratio of elements
- Albrecht test
- Reams test
- Mikhail test



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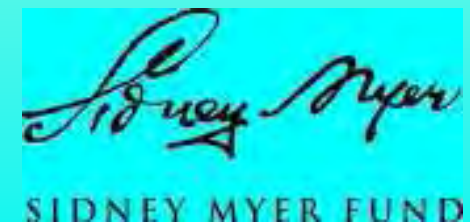
Biological Measurements



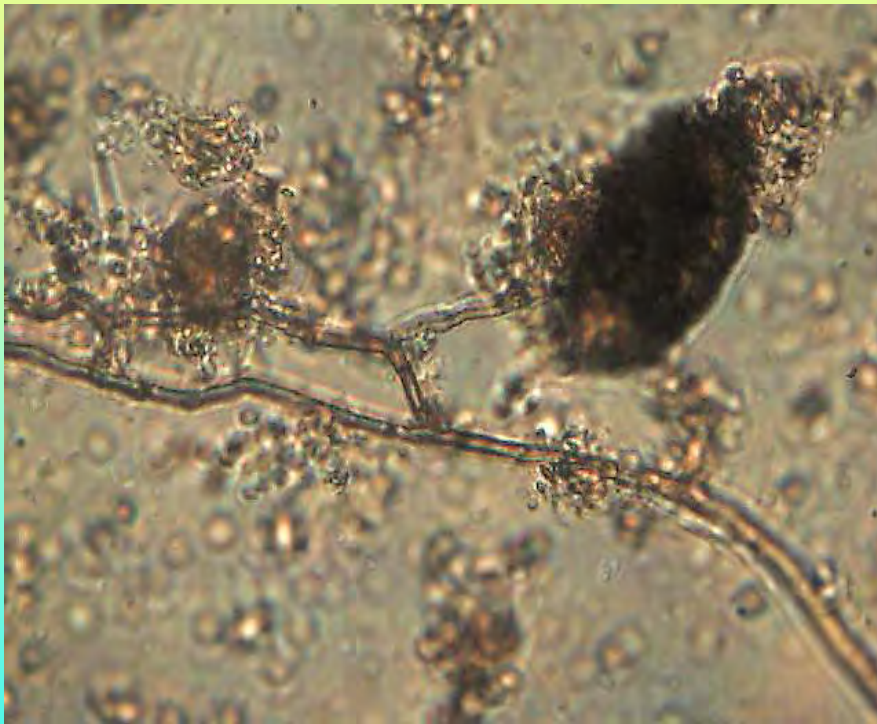
- Selective agar culture
- Indirect measurement
- DNA
- Chromatography
- Direct microscopy



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Direct Microscopy



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Soil Carbon Stability

- All soil carbon is not equal
- Labile carbon lasts up to 12 months eg. cellulose carbon
- Intermediate carbon lasts 1 to 10 years eg. glomalin produced by VAM
- Stable carbon lasts many years eg charcoal last 500 years



Bio~Char Production

- Stable carbon ~Charcaol produced from burning organic matter with minimal oxygen
- Fertile Terra Preta soil cont.cropped for 500years
- Carbon neutral/negative process
- Soil treated with biochar emits less CO2
- Trials have shown crop increases up to 300%
- Process has energy as by~product



Vesicular Arbuscular Mycorrhysa



- Filamentous fungi transfer nutrients to plant roots .SYMBIOTIC
- Increase minerals by 25% in plant
- Produces Glomalin soil glue
- Disappears with tillage
- Need live roots to persist



VAM treated Crops



Diesel Exhaust Injection

- Incorporation of exhaust into soil
- Feeds the soil micro-organisms
- System of carbon credits linked to farmers using this technology



Stubble retention



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Green Manuring

- Weed control
- Feeds Soil Food Web
- 140kg N/Ha
- Compost tea in situ



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Compost



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Compost Windrows



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Compost Turner



Compost Teas

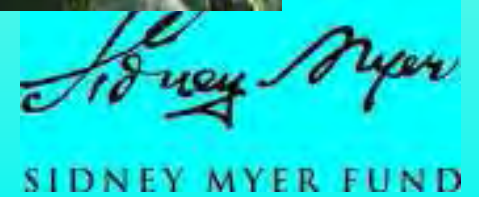


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Conclusion

- Need to scrutinize BF systems presented to us
- Increase all different carbons in the soil
- Aim to restore healthy Soil Food Web
- VAM, Biochar, Green Manuring, Stubble Digestion
- Balance Cation Exchange Capacity
- Mikail found ideal bacterial groups where CEC was balanced



