Food Security
A Critical Issue for Australia in Century 21
By Graeme Sait
The concept of **food security** typically relates to the capacity of a country to feed itself in times of crisis.

Currently, we **produce** much more than we consume.

135,000 Australian farmers produce food to the value of 60 billion dollars, **$45 billion** of which is exported.

1 in 7 jobs is in the farm-dependant economy, and 1 in 3 manufacturing jobs involve food and beverage processing.

Ours is an **agricultural economy**, but we are confronted with a growing number of **challenges**.
Food security relates to more than our capacity to feed ourselves:

- It must also relate to the **nutrient density** and medicinal qualities of the food that sustains us.
- There must also be a consideration of the increasing **chemical intervention** in food production, and the effects on our health, soil health, and planetary health.
- The misuse and abuse of **nitrogen** impacts all of these.
- **Nitrogen** is the most widely used mineral in agriculture.
- Agriculture accounts for **80%** of the nitrous oxide emissions into the atmosphere (**310** times more thickening of the blanket).
Food Security - A Critical Issue for Australia in Century 21

• Most applied nitrogen is up taken in the nitrate form, which is carried into the plant with excess water.

• This creates a dilution effect, which lowers brix levels, and seriously reduces the resilience of the plant.

• Consequently, we increase our global requirement for agricultural chemicals every year, while pest and disease pressure increases year by year.

• Using more and more, for less and less response, is literally the definition of “unsustainable”.
N and Sustainability

- Excess N burns out organic carbon & contributes to the "Greenhouse Effect".

- In fact, every one kilogram of nitrogen applied over and above the plants requirements at that time, results in the loss of 100 kilograms of carbon.

- Nitrates (NO$_3^-$) contaminate waterways, groundwater and drinking water.

- NO$_3^-$ removes O$_2$ from the blood and are proven carcinogens.
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• Excess nitrate in plants encourages **pest & diseases** to “clean up the garbage”.

• The **refractometer** often provides a guideline of the mismanagement of nitrogen.

• It is not possible to raise **brix levels** in plants with excess nitrates, as plant nutrients are diluted to compensate for high nitrate salts.

• The **nitrogen meter** is an invaluable tool to ensure optimum nitrogen management.
In-field Testing – Avoiding Blind Nutrition

The refractometer directly measures **dissolved solids** in plant sap, so it is an indication of your skills as a chlorophyll manager.

However, this essential tool indirectly measures five other things including:

1. **Monitoring calcium status** – a sharp, distinct line means calcium deficiency. The goal is to achieve a fuzzy line.

2. **Measuring boron deficiency** – brix levels should vary between late afternoon and morning. If there is no change, then sugars have not been translocated to the roots, due to the boron-controlled, trap door failing to open.
In-Field Testing – Avoiding Blind Nutrition

3. **Indicating nutrient imbalances** – brix levels should be similar throughout the plant. If there is significant variation, further investigation is warranted.

4. **Determining foliar effectiveness** - if you have made a good nutrient choice, you will see a very rapid increase in brix levels.

5. **Assessing likely weed pressure** - the weeds should always have a lower brix level than your crop, or you have fertilised for the weed.
Strategies to Improve N Management

• Currently N losses account for up to 50% of applied N.

• Each hectare already has the equivalent of over 74,000 T of N in the atmosphere (> 5,000 truckloads of urea!)

• We were supposed to get a large percentage of our nitrogen from the atmosphere.

• Our access to the ‘free gift’ is affected by several factors.
The Recipe for Free Nitrogen

**Natural N fixation** – commercial inputs can be reduced if conditions are created to enable access to free nitrogen from the atmosphere. Try compost teas, or N-fixing inoculums.

- A good **calcium/magnesium** ratio (oxygen)
- An adequate supply of soluble **phosphate** (ATP)
- Soluble **iron** (humic acid)
- **Molybdenum** (part of the nitrogenase enzyme)
- **Cobalt** (mothers milk for nitrogen fixers)
Urea as a Foliar Spray

• The single most efficient application technique for nitrogen is the use of urea as a foliar spray.

• Nitrogen en-route to plant protein, undergoes an energy-intensive (17% of energy) conversion to amines, then amino acids, then protein.

• Urea begins life as an amine but is rapidly converted to ammonium nitrogen in the soil. Foliar urea enters the plant as an amine and is much more easily converted to protein.

• Foliar urea should always be combined with humic acid to buffer and magnify.

• A 10 kg urea foliar can equal 6 x that amount when applied to the soil.
Food Security, Humus & Global Heating

- **Climate change** is the greatest challenge we will ever face, and is already having a major impact on food security.

- The single most productive strategy to counter a global warming emergency involves recognition of the importance of **humus** in the equation.

- This equation simply involves extracting CO\(^2\) from the thickening blanket and returning it to the soil, from where much of it originated.

- Our current management of **water**, the new gold, can be improved.

- An increase in just 1% organic matter means that soil can hold **170,000 L** of water per hectare, it could not previously retain.
Top Humus Building Hints

1. Don’t burn down your cover crop – a herbicide burn down results in losses of the three key nutrients that can become gasses - carbon, nitrogen, and sulphur. It is a much better strategy to work the cover crop into the A horizon (the top few inches of your soil).

2. Include legumes in every pasture and under every cereal crop – legumes, like clover, tend to feed fungi. These creatures generate the larger aggregates that create crumb structure (better infiltration and gas exchange). The clovers under your cereal crops also deliver nitrogen and they release acid exudates to prize apart calcium and phosphorus (the two most important minerals for photosynthesis).
Top Humus Building Hints

3. **Plant cocktail cover crops** – we now understand that the combination of five plant families in a blend, sponsors the release of phenolic compounds into the soil. These antioxidants spark beneficial soil-life.

- **Soil structure** changes, humus creation hastens, and **soil-life** thrives.
- The **five families** include: grasses, cereals, brassicas, legumes and chenopods.
- **Chenopods** and **brassicas** should only make up 1 - 5% of the blend, as they release chemicals that dissuade friendly fungi.
Top Humus Building Hints

4. **Discover humates** – humic acid is the most powerful promoter of the beneficial humus building fungi that are missing in most soils. Humates also sponsor **crumb structure** that can help reclaim the humus building apparatus of your soil.

5. **Embrace compost** – compost provides vast diversity and numbers of beneficial organisms to reclaim humus building capacity. There can be **5 billion** organisms in a teaspoon of compost, involving over **30,000** different species. Compost increases soil carbon by many times more than the carbon it contains.
Top Humus Building Hints

6. **Minimise tillage** – fungi do not favour the intrusion of cold steel. In fact, tillage slices and dices beneficial fungi. Every time we open our soil, we oxidise carbon and the negative impact is *quadrupled* in the wet.

- The major issue with no-till farming is that it involves *glyphosate*, amongst the most toxic chemicals ever applied to our soils.
- When this chemical is inevitably banned, roller crimpers, cover crops, and alternatives will come to the fore. *Human initiative* always delivers.
Glyphosate Is Not Medicinal

• The founder of modern medicine, Hippocrates, suggested we “let our food be our medicine, and our medicine be our food”.

• We are increasingly recognizing the profundity of this statement, as research into phytonutrients explodes.

• However, many of our major foods are now contaminated with the world’s most widely used chemical, glyphosate.

• This includes our daily bread, our dairy products, and most meat products.

• Many cereal grains fed to livestock and humans are now desiccated with glyphosate immediately before harvest.

• Most cheap loaves of supermarket bread contain 30% Roundup Ready soy, involving three sprays of glyphosate during the crop cycle.
Collateral Damage

- **Glyphosate** was originally patented as a chelating agent and can wrap around cations and make them unavailable.

- ‘**Yellow flash**’ on soybeans is a glyphosate induced **manganese** deficiency.

- Glyphosate also reduces the population of **soil organisms** responsible for making **manganese** and **iron** available.

- In one of Professor Don Huber’s studies there was a **90%** reduction in manganese reducing organisms. In another, where just **2.5%** of the applied glyphosate reached the soil, there was an **80%** reduction in manganese uptake and **50%** reduction in the uptake of iron.
Glyphosate and Your Health

- **Chronic illness** – exposure to glyphosate correlates with chronic illness.

- **Beneficial gut bacteria** – glyphosate destroys these organisms – this is well researched in chickens and cattle. It may be linked to an increasing rate of allergies and gluten intolerance.

- **Magnifies vaccines** – glyphosate makes vaccines more toxic. Exposed children are much more likely to react badly.
Glyphosate and Your Health

- **Reduced nutrient uptake** – glyphosate is a chelating agent that kills plants through shutting down nutrients, it works the same in humans. Glyphosate-induced vitamin deficiency may have a cancer link.

- **Non-Hodgkins lymphoma** – exposure to glyphosate doubles the likelihood of B-cell lymphoma.

- **Debilitates cytochrome P450** – this is the longevity gene related to detox enzymes.

- **Kidney failure** – Sri Lanka has just banned glyphosate due to an overwhelming number of liver and kidney problems.
Huber’s Other Findings

• New research has linked glyphosate to **spontaneous abortion** in animals but the research has yet to be done for humans.

• Professor Don Huber has directly linked **40 plant diseases** to the use of glyphosate.

• *Pseudomonas fluorescens* is one creature that is killed by glyphosate. This bacteria protects against take-all and several other diseases.

• Glyphosate locks up trace minerals and creates a **disease susceptible** plant.

• The World Health Organisation have recently completed an in depth analysis of the safety of glyphosate. They have formally recognised that glyphosate is a carcinogen.
Collateral Damage

• **Algae** are plant-like creatures that serve as an important **food source** for fungi and bacteria.

• **Herbicides** like glyphosate kill algae and shut down this food supply.

• Algae are found in the **top 6 inches** of the soil so despite the loss of the top layer of organisms (found on the surface to access sunlight for **photosynthesis**) there is a good chance they can regenerate.

• However, if the herbicide remains in the soil then this **regeneration** is compromised.
Reducing The Damage

- **Glyphosate** takes at least 6 months to biodegrade in the soil, but then it becomes AMPA, a more damaging and persistent chemical (11 years minimum).

- There is a strategy to make glyphosate less damaging.

- It involves the following trio:

  1. **Combine soluble fulvic acid powder** with glyphosate at the rate of 150 grams per hectare. The 1400 CEC fulvic speeds decomposition (the honeypot effect).

  2. **Reduce the pH** of the diluted herbicide **down to 2.9** with citric acid. This can immediately reduce the herbicide requirement by 30%.

  3. **Add a good sticker/penetrant** (a spray oil).
7. **Bring back your earth worms** – Earthworms are missing in most soils, and there is a price to pay for this loss.

- Earthworms create humus **4 times** more rapidly than standard decomposition.
- They also produce a **fertiliser** from their rear ends, featuring 10 times more potassium, 7 times more nitrogen, 5 times more phosphorus, 3 times more magnesium, and 150% more calcium.
- If you can achieve the holy grail of **25** earthworms per shovelful, they will produce **300 tonnes** of earthworm castings per hectare annually.
- Earthworms also **incubate** a unique group of beneficial organisms that will be lacking in your soil, if the earthworms have gone.
Food Security and Increased Resilience

In the brave new world of **climate change**, we are set to experience more drought, more floods, more frosts, more heatwaves and more storms.

In this scenario, **resilience** becomes hugely important.

One proven resilience strategy involves maximising **mineral balance**, to provide optimum building blocks to boost bounce-back capacity.

This includes the understanding of soil pH, **key mineral ratios** and crop monitoring with leaf analysis.
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**MULDER’S CHART**

Antagonism  
A decrease in availability to the plant of a nutrient by the action of another nutrient. (see direction of arrow)

Stimulation  
An increase in the uptake of a nutrient by the plant because of the increase in the level of another nutrient.
The Key Ratios

1. Ca : Mg ratio
2. Mg : K ratio
3. P : S ratio
4. P : Zn ratio
5. K : Na ratio
6. Fe : Mn ratio

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<table>
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<tr>
<th>ALBRECHT CATEGORY</th>
<th>YOUR LEVEL</th>
<th>IDEAL LEVEL</th>
<th>NUTRIENT STATUS</th>
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<tr>
<td></td>
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<td>LOW</td>
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<td>CEC</td>
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<td>TEC</td>
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<td>Paramagnetism</td>
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<td>200 +</td>
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<td>pH-level (1.5 water)</td>
<td>6.40</td>
<td>6.3</td>
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<td>Organic Matter (IR Gas Anal.)</td>
<td>6.52 %</td>
<td>4 - 10 %</td>
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<tr>
<td>Conductivity (1:2 water)</td>
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<td>0.2 - 0.6 mS/cm</td>
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<tr>
<td>Ca / Mg Ratio</td>
<td>1.95:1</td>
<td>7.00:1</td>
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<td>Nitrate-N (Morgan)</td>
<td>29.7 ppm</td>
<td>10 - 20 ppm</td>
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<tr>
<td>Ammonium-N (Morgan)</td>
<td>11.2 ppm</td>
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<tr>
<td>Phosphorus (Mehlich III)</td>
<td>23 ppm</td>
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<td>Calcium (Mehlich III)</td>
<td>4052 ppm</td>
<td>4839 ppm</td>
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<td>Magnesium (Mehlich III)</td>
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<td>Potassium (Mehlich III)</td>
<td>114 ppm</td>
<td>404 - 809 ppm</td>
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<td>5 ppm</td>
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<td>0.70 ppm</td>
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<td>Iron (DTPA)</td>
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<td>Zinc (DTPA)</td>
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<td>Molybdenum (Nitric Acid)</td>
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<td>Cobalt (Nitric Acid)</td>
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<td>Selenium (Nitric Acid)</td>
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<td>0.6 - 2 ppm</td>
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<td>Texture</td>
<td>Clay Loam</td>
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</tr>
<tr>
<td>Colour</td>
<td>Red Brown</td>
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BASE SATURATION
(Levels are not really relevant in soils with a TEC below 5)

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<tr>
<td>Calcium</td>
<td>58.62 %</td>
<td>70.00 %</td>
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<tr>
<td>Magnesium</td>
<td>30.07 %</td>
<td>10.00 %</td>
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<tr>
<td>Potassium</td>
<td>0.85 %</td>
<td>3.00 - 6.00 %</td>
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<tr>
<td>Sodium</td>
<td>1.31 %</td>
<td>0.50 - 1.50 %</td>
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<tr>
<td>Aluminium</td>
<td>0.16 %</td>
<td>0.50 %</td>
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</tr>
<tr>
<td>Hydrogen</td>
<td>9.00 %</td>
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Leaf Testing – Removing the Guess Work

Understanding “The Big Four”

• When **four minerals** are maintained at luxury levels, according to a leaf test, there can be a very productive outcome.

• The **big four** minerals include; calcium, magnesium, phosphorus and boron.

• All four are directly related to the most important of all plant processes, **photosynthesis**.

• The sad story is that in **30%** of all of the leaf tests we analyse, all four of these important minerals are deficient (let alone at their optimum level).
### PLANT THERAPY™

**DATE:** 02.04.2009  
**NAME:** Mr Sample  
**ADDRESS:** -  
**LAND USE:** Rye Grass  
**Paddock:** Sample Paddock  
**SAMPLE REC:** 28.03.2009  
**CONTACT NO:** xx xxxxx xxxx

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<th>ELEMENT OR CATEGORY</th>
<th>YOUR LEVEL</th>
<th>ACCEPTABLE RANGE</th>
<th>DEFICIENT</th>
<th>ACCEPTABLE</th>
<th>EXCESSIVE OR TOXIC</th>
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<td>N - Nitrogen</td>
<td>4.5 %</td>
<td>2.3 - 4.2 %</td>
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<tr>
<td>P - Phosphorus</td>
<td>0.15 %</td>
<td>0.2 - 0.5 %</td>
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<tr>
<td>K - Potassium</td>
<td>3 %</td>
<td>1.5 - 3.5 %</td>
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<tr>
<td>S - Sulphur</td>
<td>0.54 %</td>
<td>0.2 - 0.45 %</td>
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<tr>
<td>Ca - Calcium</td>
<td>0.11 %</td>
<td>0.2 - 0.6 %</td>
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<tr>
<td>Mg - Magnesium</td>
<td>0.14 %</td>
<td>0.16 - 0.4 %</td>
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<tr>
<td>Na - Sodium</td>
<td>0.3 %</td>
<td>&lt; 0.7 %</td>
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<tr>
<td>Cu - Copper</td>
<td>8 ppm</td>
<td>5 - 12 ppm</td>
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<tr>
<td>Zn - Zinc</td>
<td>20 ppm</td>
<td>15 - 50 ppm</td>
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<tr>
<td>Mn - Manganese</td>
<td>100 ppm</td>
<td>50 - 300 ppm</td>
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<tr>
<td>Fe - Iron</td>
<td>55 ppm</td>
<td>50 - 60 ppm</td>
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<tr>
<td>B - Boron</td>
<td>3 ppm</td>
<td>5 - 15 ppm</td>
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<tr>
<td>Mo - Molybdenum</td>
<td>0.16 ppm</td>
<td>0.15 - 0.5 ppm</td>
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<tr>
<td>C - Carbon</td>
<td>%</td>
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The Desperate Need For Diversity

- We are pummeled with propaganda claiming the need for more chemistry and GMO crops to feed 9 billion people within 3 decades.

- It is such nonsense, the undeniable fact is that annual monocrops are dangerously close to destroying the network of ecosystems, that allow a resilient, productive food system to exist.

- The current model involves growing a handful of cereal and legume crops, on our best soils and in the process we are exporting 5 tonnes of top soil, per person, down our rivers.

- This is a virtual guarantee of failure, to feed the future billions (in 60 years, no top soil remains).
Alternatives To The Industrial Model

- Russia has **145 million** people, with 35 million families living on small farms or plots of less than 1 acre.

- These small blocks feed **71%** of the population. They provide **92%** of the potatoes, **87%** of the fruit, and **77%** of the vegetables.

- Most of this food is produced without chemicals, and soils are nurtured, so we do know that the industrial model is not essential.

- **Top soil, water, and biodiversity** are our most precious natural resources. We must realise their profound significance, and find a way to maintain their integrity.
Crop Diversity - Biodiversity

- In his important book ‘The Farm as an Ecosystem’, Jerry Brunetti, states:

> “In order for humanity to have a wholesome, healthy, and joyful existence, the extinction, destruction, and sterilising homogenisation of our landscapes, must be terminated, and then restored”.

- Pulitzer Prize winning author, E.O. Wilson, wrote ‘The Diversity of Life’. He states:

> “I will argue that every scrap of biological diversity is priceless, to be learned and cherished, and never to be surrendered without a struggle”.

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Food Security - A Critical Issue for Australia in Century 21
In Conclusion
Australia is a major food exporter, and in this context, the resilience of our cropping systems directly impacts our national finances.

The loss of between 7-10 tonnes of top soil per hectare per year, burgeoning drought, and increased pest and environmental pressure, associated with climate change, have combined to threaten that ongoing resilience.

There are multiple strategies to help us survive and thrive, amidst the maelstrom.

However, action must replace apathy, sooner rather than later! Thank you!