



Water Supplements In  
Solution Pty Ltd

*Advances in Water  
Supplementation  
for Livestock  
2025*

Dr Tony Wood

[watersupp.com](http://watersupp.com)



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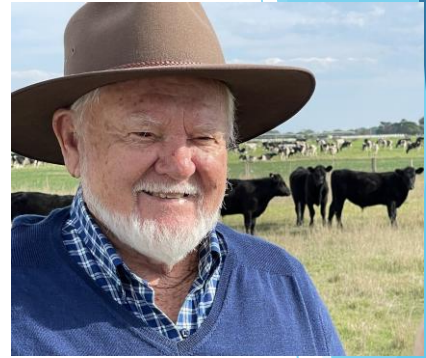
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# Introduction

## *Advances in Water Supplementation*



- Dr Tony Wood has been involved in water supplementation for over 35 years and has developed the hardware systems and formulas still in use today.
- The principle of water medication is to use a dispenser to inject soluble ingredients into the drinking water.
- Animals drink according to their body weight so all classes of animals will receive the correct dosage. Rumen microbes benefit from the increase in nutrients, leading to increased fermentation.
- Supplementation of the major nutrients of Nitrogen, Phosphorus and Sulphur stimulates rumen activity and has resulted in considerable gains in productivity with reduced costs.
- Entwistle and Jephcott in 2005 reported productivity gains in gross margins of up to 57% in P deficient country and 7% in marginally P deficient country when Phosphorus was supplemented.
- They also reported higher weight gains and higher fertility rates in animals supplemented with Nitrogen throughout the dry season in many grazing systems throughout Queensland and the Northern Territory.

# Introduction

## *Advances in Water Medication @ Supplementation*

- ▶ There have been improvements in hardware, software, telemetry, formulations and an increased understanding of microbiological systems in rumen fermentation.
- ▶ The improvements have increased the safety and stability of supplying the major nutrients of Nitrogen, Phosphorus and Sulphur and have extended to the supply of trace elements as required as well as a stabilised Vitamin A & E when it is needed.
- ▶ Improvement in cellulose digestion can also be achieved by an understanding of rumen microbe functions and the inclusion of soluble carbohydrates in the formulations in the late dry season.
- ▶ Advances in enzyme availability have also made cellulase enzymes available for feeding through the drinking water.
- ▶ Greater pasture analysis has shown the need for increased supplementation in the wet season and the need to ensure sufficient Phosphorus is available.
- ▶ The introduction of the BAG MIX principle of formulation has reduced feeding costs considerably as well as providing greater flexibility in formulation.
- ▶ Safe urea compounds have been developed, and in many cases, no free urea is needed. A new development is to compound safe urea compounds on farm, resulting in even greater savings.
- ▶ New compounds for pain and stress control, as well as fly relief have been developed.



# Water Supplements In Solution Pty Ltd

## *Advances in Hardware*

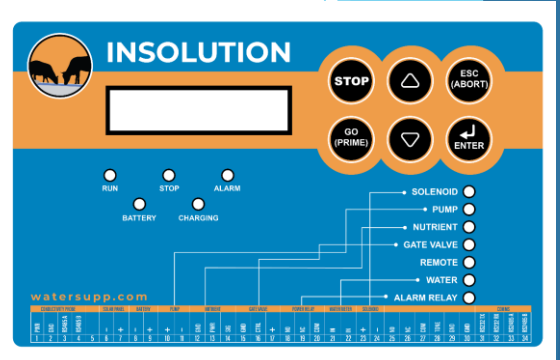
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# Advances in Hardware

## In Solution - Dosing

The In Solution dosing controller is one of the most sophisticated units available and has been designed specifically to ensure safe and accurate dosage.

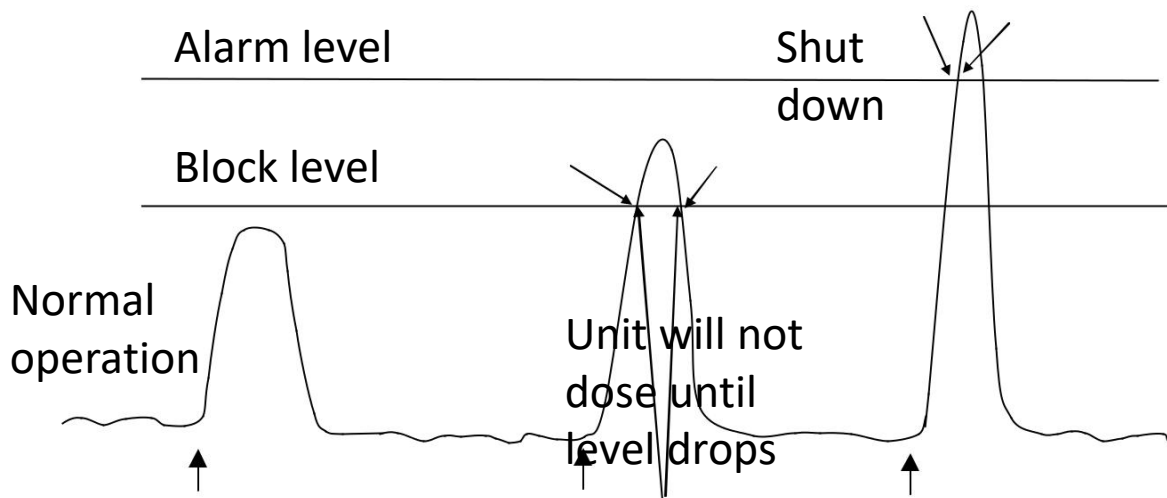


- The primary pump control is a a timed dose. This is because it is a reliable method and not subject to variation. The flow meter is used to detect flows and measure the dose but is not used as the primary control as it is subject to variations.
- An electronic gate valve has been placed between the nutrient tank and the controller so that if the controller detects an alarm state the gate valve closes and the nutrient concentrate tank is isolated.
- A flow meter measures each dose of nutrient injected. If the flow meter detects an overdose or any flow not associated with a scheduled dose then the system alarms and shuts down.
- A solenoid valve is located between the pump and the water line. This is only open when the pump runs so the system is isolated when not injecting.
- An optional conductivity probe measures the amount of each dose as it is injected. If the probe detects an overdose or inadequate mixing the system alarms and is shut down.
- The controller can detect a burst pipe and shut down, thus saving on loss of supplements.

# Advances in Hardware

## In Solution – Conductivity Probe

The **In Solution** optional conductivity probe measures each dose as it is injected into the water line, The injection level measured can be used to control the system.



- Blocking levels and alarm levels are set.
- The controller cannot inject another dose if the conductivity rises above the block level.
- The unit will restart when the level drops.
- The controller alarms and shuts down, isolating the concentrate tank if the level rises above the alarm setting.

# Advances in Hardware

## In Solution – Pressure Sensors

The **In Solution** optional pressure sensors can detect water tank and concentrate tanks levels.



- Water tank and concentrate tank levels are measured
- The unit alarms when concentrate levels fall to zero.
- Tank level data is sent to the server and can be seen on the dashboard if remote monitoring is active.

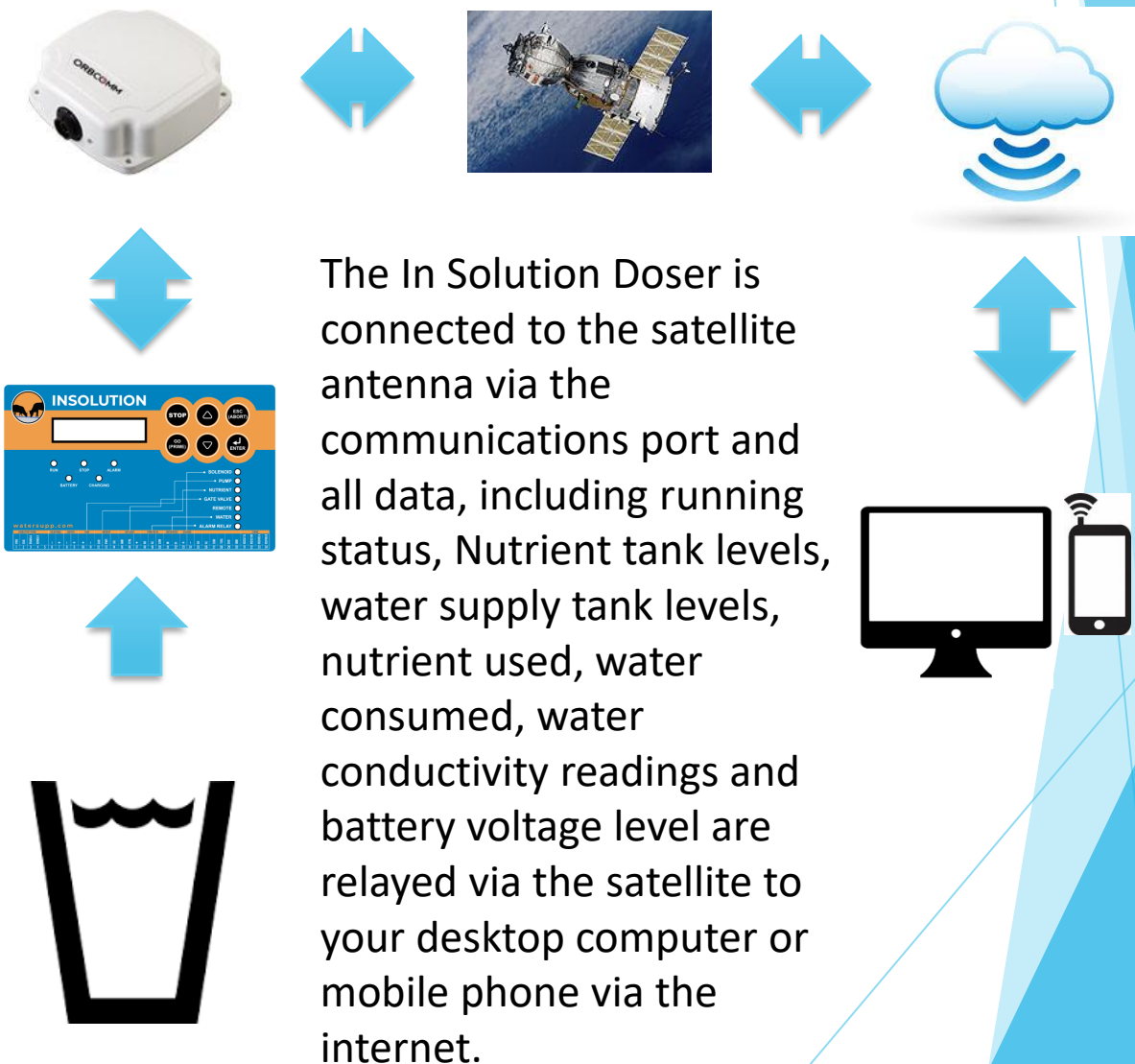


# Advances in Hardware

## In Solution - Satellite

### **Satellite Monitoring:**

The In Solution controller can now be connected by 4G, Internet or satellite.

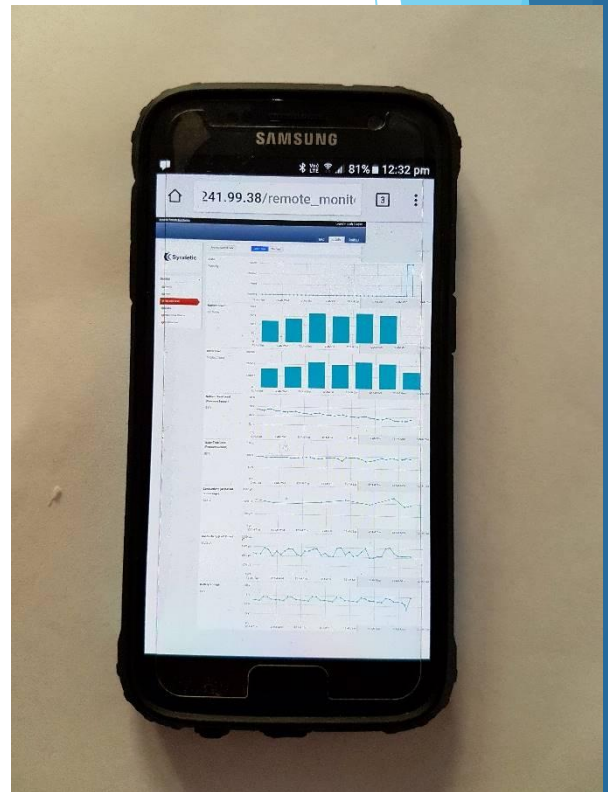


# Advances in Hardware

## In Solution - Dashboard

All of the data is available on your mobile device or on your desktop via the internet. This data will tell you the status of the system, that is if it is running, stopped or if it has been shut down by alarms and give all tank levels.

- The controller can be stopped and restarted remotely via the satellite.
- When viewing the data information will be available on the nutrient tank level as well as the level in any supply tank.



Other communication systems such as 4G, LORA and internet are also available if applicable.

# Advances in Hardware

## In Solution – Dosing Unit

The **In Solution Dosing Unit** can be mounted on a Skid or trailer for a mobile installation that better suits cell grazing.

Cam lock connections make connection fast and easy.



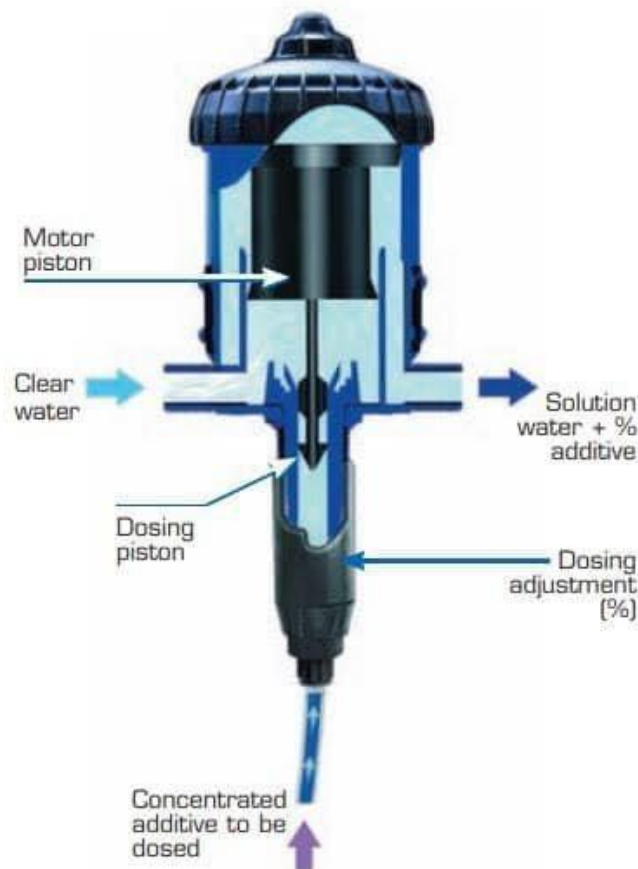
- Water meter, battery, solar panel, pressure sensors, conductivity sensor and modem all connect to outside of the Stainless Steel Box.
- The controller, pump, solenoid, flow meter and shut off valve are mounted inside a stainless steel box and have quick release joiners, allowing easy removal for maintenance.

# Advances in Hardware

## Dosatron

The Dosatron is a reliable unit and very suited to water supplementation. It requires approximately 2 bar of pressure to run.

The Dosatron can now be fitted with electronic controls and all of the safety features seen in the In Solution controller, including solenoid valve, conductivity probe, tank pressure sensors, water flow meters, as well as on farm connectivity systems.



# Advances in Hardware

## Chemilyzer HN55

The ChemilyzerHN55 is a reliable unit and very suited to water supplementation on single troughs. It requires approximately 2 bar of pressure to run.

The chemilyzer can now be fitted with electronic controls and all of the safety features seen in the In Solution controller, including solenoid valve, conductivity probe, tank pressure sensors, water flow meters, as well as on farm connectivity systems.

The flow rate of 2900 l/h ensures plenty of water flow.

This is an economical solution to delivering water supplements, especially to small herds and single troughs.





Water Supplements In  
Solution Pty Ltd

*Making  
supplementary  
feeding safer*

Dr Tony Wood

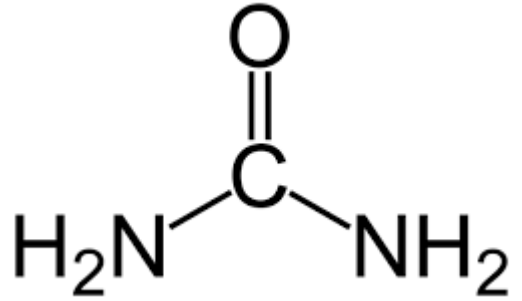
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# Urea Stability

## Urea in Water

### ***Stability***

- Urea can be unstable and break down into ammonia in any type of water.
- Breakdown is accelerated in alkaline waters or waters that contain the enzyme urease, generally produced from biological sources.



### ***What Happens?***

- Under alkaline conditions, which include most bore waters, the urea will breakdown to ammonia.
- This is most recognisable by an ammonia smell at the tank or trough.
- The ammonia will increase the pH of the water up levels of 9.
- The ammonia will be lost to the atmosphere.
- The ammonia smell is not attractive to cattle and they will show some reluctance to drink, often putting their nose under the water when drinking.

# Urea Stability

## Urea in Water

### *How do I Check?*

- You can smell the ammonia with your nose, it is distinctive.
- You can use an ammonia test strip to check the level.
- An ammonia meter can also be used.



### *What do I do?*

- You will need to stabilise the urea to prevent or reduce the breakdown to ammonia.
- Each bore will be different and you will need a water sample that shows the bicarbonate alkalinity to calculate the best amount of stabiliser required.
- The best stabiliser is urea phosphate.

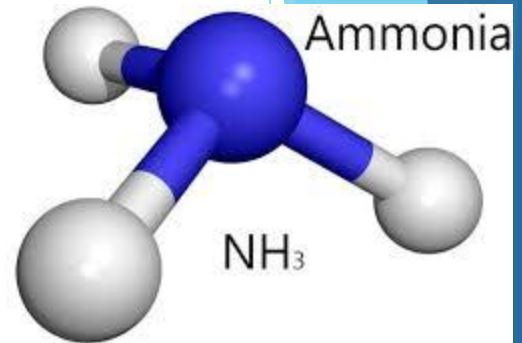


# Safe Urea

## Making urea safe

### *How is urea toxic?*

- Urea itself is not toxic.
- It is only when the urea molecule is broken down into two ammonia molecules by the enzyme urease in the rumen and that ammonia is absorbed into the bloodstream in high levels that toxicity occurs. Ammonia is toxic.



### *What is Safe or Slow Release Urea?*

- When urea is combined with another phosphorus molecule a strong bond between the molecules is established.
- This molecule (Urea Phosphate) is not able to be broken down by the enzyme urease and so no ammonia is released and no toxicity occurs.
- The molecule is broken down by other pathways and as the urea is free it can then be broken down by urease to ammonia.
- This slows the breakdown of urea.
- The best example is the compound Urea Phosphate.
- Another example is Biuret, where two urea molecules are fused together and only slowly broken down.

# Safe Urea

## Safe, Stabilised and Slow Release Urea

### *Urea Phosphate is a Safe, Non-Toxic Source of urea*



- This compound has unique properties that make it highly desirable in the formulation of soluble supplements.
- It is a slow release form of urea.

- The strip above measures urea nitrogen and it contains urease. The urease breaks free urea down to ammonia and the strip then measures that by changing colour.
- It can be seen that the UP strip remains unchanged, while the ammonia released in the Urea treated strip turns green within a few seconds.
- UP is strongly acidic (pH 2) and acts to buffer the high bicarbonate bore waters, thus stabilising urea and slowing its decay to ammonia.
- It contains Phosphorus, a vital element for growth.
- It is completely and rapidly soluble and ideal for water supplementation.

# Safe Urea

## Safe, Stabilised and Slow Release Urea

***Urea Phosphate is used in formulations to improve stability and safety***



- Used alone it is safe and will not cause ammonia toxicity.
- It is a slow release form of urea.
- It is used in formulations to replace urea. It can replace 100% of the urea, making the formula non toxic.
- As an acid it stabilises urea and also slows the activity of the enzyme urease.
- A formulation containing 50% UP will slow the rate of ammonia release from urea and improve safety, however, to ensure safety 100% replacement ensures there is no free urea available.
- In addition, if you are feeding urea, UP is an acid and any ammonia produced will be converted to the non toxic ammonium ion in an acid environment.



Water Supplements In  
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***Safer  
Formulations***

Dr Tony Wood

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# Safer Formulations

## Safer Formulations

### ***New Formulations***

- In Solution have developed formulations designed to improve the stability and safety of supplementary feeding through the drinking water.
- These formulations are designed for various water sources and feeding situations.
- Formulations to suit your exact water analysis are also available.
- Please contact [Dr Tony Wood](#) to design the formula that will suit your water and conditions.

### ***Less free urea is better***

- Free urea in a formulation is the source of toxicity
- By reducing free urea to a minimum, or zero, completely safe formula that deliver the requirements of N, P, S and trace elements can be provided.



# Advances in Formulations

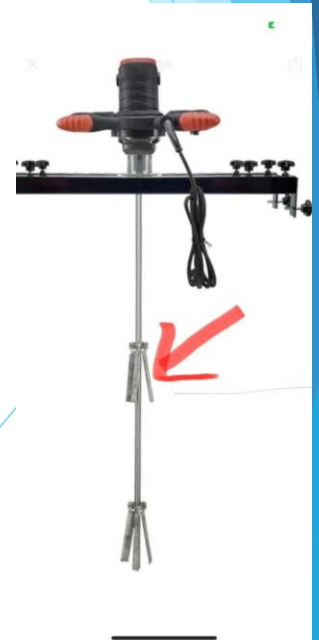
## BAG MIX Formula

### ***Bag Mix Formula***

- Bag Mix formula saves money with no extra effort.
- Where you will be asked to pay \$3500 per tonne for a mixed formula, you can make the same formula as a bag mix for under \$2100 per tonne. Worth saving?
- Trace elements can be included in all formula at rates that suit the operation.

### **How does it work?**

- Add ingredients to an IBC according to number of bags required. For example, add 4 bags Urea Phosphate and 1 bag Sulphate of Ammonia to make a 12.5% concentrate.
- Add water to 1000 litres and mix until dissolved.
- Mix with fire fighter or stirrer.
- Dose at the rate of 100 ml per 10 litre pulse to give 1.25 g/l in water.
- To increase the concentration, add additional bags, for example to make a 50% concentrate add 16 bags UP and 4 bags SOA and dose at the rate of 100 ml per 4 pulses or 40 litres.



# Safer Formulations

## BAG MIX Formula Examples

### Zero Urea Formula

- Add ingredients to an IBC according to number of bags required. For example, add 4 bags Urea Phosphate and 1 bag Sulphate of Ammonia. Add water to 1000 litres and mix until dissolved. Dose at the rate of 100 ml per 10 litre pulse to give 1.25 g/l in water.
- Analysis: Crude Protein 115% Nitrogen 18.4% Phosphorus 15.4% Sulphur 4.8%
- Feed 60 grams per day to give 9.2 grams P and 24 grams urea equivalent at a cost of 12 cents per head per day.
- Will suit all conditions where there is some green pick to tropical grasses like para grass.

### Low free urea Formula

- Add 1 bag Urea, 3 bags UP and 1 bag SOA. Fill IBC to 1000 l and mix. Dose at the rate of 100 ml per 10 litre pulse to give 1.25 g/l in water.
- Analysis: Crude Protein 151% Nitrogen 24.2% Phosphorus 11.5% Sulphur 4.8%
- Feed 60 grams per day to give 7 grams P and 30 grams urea equivalent (12 g of free urea) at a cost of 10 cents per head per day.
- Will suit all conditions where there is some green pick to early dry pasture

# Safer Formulations

## BAG MIX Formula Examples

### Maximum Urea formula for safety

- Add 2 bags Urea, 2 bags UP and 1 bag SOA. Add water to 1000 litres and mix until dissolved. Dose at the rate of 100 ml per 10 litre pulse to give 1.25 g/l in water.
- Analysis: Crude Protein 151% Nitrogen 24.2% Phosphorus 11.5% Sulphur 4.8%
- Feed 60 grams per day to give 4.6 grams P and 39 grams urea equivalent at a cost of 12 cents per head per day. Contains 24 grams of free urea.
- As free urea is not normally toxic under 100 grams dosage for an adult animal, so this formula is still very safe.
- Will suit all conditions where there is only dry pasture.
- If pasture conditions deteriorate then consider providing additional oil meals to supplement the herd, particularly younger animals.



# Ready to use Premixed

## Minimum order 5 tonne

### Premixed 25 Kg Bags

- All of the above formula are available in 25 kg bags.
- Add 20 bags (500 Kg) to an IBC tank and fill to 1000 litres with water.
- This will give a 50% solution, as above
- Other strength concentrates can be used, for example add 4 bags to 100 l to give a 100 G/l concentrate and dilute this at 100 ml per 10 litres to give a water concentration of 1 gram per litre.

# Phosphorus, Nitrogen and Magnesium

## A new approach

### Bag Mix Formula

- The rumen cellulolytic bacteria have an absolute requirement for magnesium.
- Feeding additional magnesium through the drinking water is an economic means of providing additional magnesium and stimulating the rumen micro organisms.
- A bag mix formula of 4 bags of Urea Phosphate and 2 bags of Magnesium sulphate to 1000 litres of water. Dilute at the rate of 100 ml per 10 litres to give a concentration in the water of 1.5 grams per litre. Cattle drinking 40 litres will receive 2 grams of Magnesium, 7.6 grams of Phosphorus and 4.7 grams of Nitrogen.
- This formula can be varied as the pasture changes.
- Field experience has shown that this formula is ideal for feeding on green pastures as well as oats and will reduce scouring.

# Phosphoric Acid based Formulations

## A new approach

### Phosphoric Acid 85%

- By using Phosphoric acid as the base for our formulations it enables us to achieve greater flexibility in formulation and also make significant cost savings.
- Phosphoric is available in 1000 litres IBC containers. Smaller quantities are available but are not economic.



### How to Formulate

- Phosphoric acid reacts with urea, forming a stable crystalline compound, urea phosphate. The reaction generates heat and crystals of urea phosphate will form. These are easily dissolved when water is added.
- Various formulations are possible, each designed to deliver Nitrogen, Phosphorus and Sulphur in the safest and most economical way possible.
- Formulations are easily changed according to seasons and animal requirements.
- Please contact Dr Tony Wood to help you design the formula that suits you best.

# Advances in Formulations

## Trace Minerals

### *The Daily requirements of trace minerals (NRC)*

Mineral	Requirement ppm dry matter eaten	Mg per day	drinking water ppm
Iron	50	450	15
Manganese	40	360	12
Zinc	30	270	9
Copper	10	90	3
Iodine	0.5	4.5	0.15
Selenium	0.1	1.0	0.03
Cobalt	0.1	1.0	0.03
Molybdenum	1	9	0.3

- Cobalt and selenium are only required in very small quantities compared to the other trace elements.
- Copper, Cobalt and Selenium are deficient in most coastal areas of Australia. Zinc levels are marginal in large parts of Queensland and the Northern Territory.
- Iodine is regarded as marginal throughout Australia. Molybdenum is not regarded as deficient.

# Advances in Formulations

## Trace Minerals

### *The importance of trace minerals*

#### **Copper**

- Deficiency in livestock can result from low dietary copper levels, high levels of the mineral molybdenum, high levels of iron and/or high levels of sulphates in drinking water or in the feed.
- The majority of forages grown in Eastern Australia and South Australia are deficient in copper.
- Copper deficiency occurs in three main areas in Queensland:
  1. sandy soils along the east coast
  2. some soils on the Downs extending from Texas to slightly west of Tara
  3. on the Brigalow development area around Taroom and Wandoan.
- Deficiency symptoms include anemia, loss of colour in the haircoat, digestive upset and poor animal performance (growth, lactation and/or reproduction).
- Copper levels in hair samples are highly variable, while liver copper profiles provide a better indicator of the copper status of the animal.

# Advances in Formulations

## Trace Minerals

### *The importance of trace minerals*

#### **Zinc**

- Zinc deficiency in livestock is manifested by reduced growth rate, reduced fertility, para keratosis (thickening and scaling of skin cells), loss of hair, dermatitis (inflammation of the skin), and an increased susceptibility to foot rot and other foot infections.
- While clinical cases of zinc deficiency are rare, sub-clinical deficiencies can be more accurately assessed with a feed analysis that will help determine a potential deficiency and possible solution.
- Low zinc levels are common throughout Australia and in most cases there is a case for providing supplemental Zinc.

#### **Manganese**

- Manganese is not normally deficient. Deficiency in livestock impairs reproductive performance, skeletal deformities and contracted (shortened) tendons in new born calves, enlarged joints and reduced birth weight.
- There is some evidence that excessively high calcium in the ration predisposes a manganese deficiency.

# Advances in Formulations

## Trace Minerals

### *The importance of trace minerals*

#### Iodine and cobalt

- Feed source levels of iodine and cobalt are generally very low in many parts of Australia and therefore require supplementation.
- Iodine deficiencies can be manifested by weak or stillborn calves, calves that may be hairless, goitre, impaired fertility, retained placenta and increased susceptibility of soft tissue to infection.
- Animals have no known requirement for cobalt other than as a constituent of Vitamin B<sub>12</sub>. Therefore, deficiency symptoms described for Vitamin B<sub>12</sub> apply to cobalt. Deficiency symptoms are commonly expressed by a "starvation-like" body condition, rough hair coat, discharge from the eyes, anemia and reproductive failure.

# Advances in Formulations

## Trace Minerals

### *The importance of trace minerals*

#### **Selenium**

- Selenium deficiency problems are common, especially in the thin black, black and grey wooded soil zones.
- Selenium deficiency is most commonly expressed as white muscle disease, but also results in reduced disease resistance, retained placenta and weak or dead calves.
- Deficiency symptoms are commonly expressed in calves that tend to "lie around", may lack an aggressive suckling ability, and/or are chronically stiff.
- Vitamin E metabolism is similar to selenium and deficiencies can be expressed as having the same symptoms as selenium deficiency.
- Vitamin E and selenium are usually administered jointly where clinical symptoms occur. To some extent, one can replace the other, but not completely.
- Since selenium is extremely toxic, great care should be exercised when including selenium in a mineral mix or a ration.
- Feeding directions for this trace mineral must be followed carefully.



# Advances in Formulations

## Trace Minerals

### *The importance of trace minerals*

#### Diagnosis of trace mineral deficiency

- Diagnosis of trace mineral deficiencies should be based on a complete assessment of the animal group, a feed and water analysis and sampling, and evaluating of blood and animal tissues (liver biopsy or from slaughter animals).
- Single criteria or individual animal diagnosis is generally not sufficient to adequately address trace mineral deficiency problems.
- Due to complex interaction between trace minerals and macro-minerals, as well as the other elements which affect the absorption, retention and utilization, a broad comprehensive overview of the management scenario must be undertaken when developing minimum and maximum levels for a mineral program.
- The trace mineral supplement used can be mixed according to individual requirements.

# Advances in Formulations

## Trace Minerals

### *Formulation of Liquid Trace Minerals*

Active Ingredient	Mg/L
Iodine	760
Cobalt	420
Copper	12500
Zinc	21500
Selenium	880
Sulphur	14650

- Trace minerals are a water soluble solution containing the major trace elements required by sheep and cattle.
- They are designed to supplement pasture intakes and can be also used to provide the complete requirements of animals.
- The liquid trace element formula is added to the concentrate tank containing the Urea mix at a rate of 3 to 5 litres per 1000 litres of concentrate. In highly deficient areas more can be used.
- Trace minerals are in a form best used by the rumen microbes.

# Advances in Formulations

## Vitamin A & E

### Vitamin A & E Requirement

- Vitamins are not usually a problem with grazing cattle in Australia as most vitamins are synthesized by rumen microorganisms.
- The exceptions are vitamins A and E which are readily available in high quality forage, but may become limiting during extended periods without green feed.
- Vitamin A is stored in the liver. The liver has stores of Vitamin A that last for about 12 weeks and after prolonged dry periods, vitamin A stores become depleted. This seldom occurs where cattle are in forest country or have access to browse because the green leaf will supply an adequate amount of vitamin A.
- The first sign of vitamin A deficiency is often picked up when cattle are loaded at night time. This is because vitamin A causes night blindness.
- Other signs are a rough coat, reduction in feed intake and joint oedema.
- Vitamin A deficiency in cows during early pregnancy can affect the development of their calf's brain in utero resulting in calves dying soon after birth.
- This makes it important to ensure there is adequate Vitamin A around the time of mating and during early pregnancy.

# Advances in Formulations

## Vitamin A & E

***Stable  
Formulation***

***54 cents  
per head***

- Using a In Solution dispenser, simply add the total dose of 25 ml per head to any volume in the concentrate tank and allow the cattle to drink this down.
- This will ensure the total dose is delivered during the period it takes to consume the concentrate.
- The formulation is stable in the concentrate so there will be no loss of potency.
- 25 ml of Vitamin A&E will provide 2.5 million units of Vitamin A and 1250 mg of Vitamin E at a cost of 54 cents.
- The formulation does not contain Vitamin D, however as this is generated in cattle by sunlight it is not necessary to add.
- This is less than half the cost of injection and administration costs are very low and avoids any injection damage.

# Advances in Formulations

## Cellulase

### *Cellulase is an important enzyme*

- Enzymes are present in all natural systems. Cellulase is important in the digestion process of all plant eating animals as it breaks down indigestible cellulose to glucose, which can be utilised.
- Enzymes have been fed to animals for many years to increase production and their effects in increasing the digestion of cellulose, along with other compounds such as phytate are well known. Feeding cellulase to dairy cows increases milk production by up to 25 % and feedlot cattle have shown responses of around 7% in live weight gains.
- To feed enzymes to pasture fed cattle has been difficult until now. Water supplementation is the ideal way to deliver precise doses of cellulase enzymes to pasture grazing cattle through the drinking water.
- This is particularly important during dry seasons. Cellulase will help the rumen bacteria digest more dry feed and therefore increase dry feed intake.
- In Solution has water soluble cellulase for feeding during the dry season.



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Solution Pty Ltd

# *Animal Welfare*

Dr Tony Wood

[watersupp.com](http://watersupp.com)

# Advances in Animal Welfare

## Anti Stress Formula

### ***Relieving stress due to mustering, weaning and transport is a necessity.***

- Anti stress formula are now available as a Bag Mix System, bringing you greater flexibility and savings.
- These formulations are designed to help in all stress conditions, such as mustering, yarding, weaning, marking and transport.
- For weaning they are combined with the provision of high quality energy and protein sources to ensure weaners continue to grow and thrive during the process.
- For adult cattle held in yards without access to feed, they help to prevent “Dead Belly” where the rumen bacteria die off and fermentation shuts down.
- For transport cattle it gives the required electrolytes, minerals and other ingredients that calm animals and help prevent dehydration.
- The Bag Mix formula using trace elements, magnesium, glucose and electrolytes allow you to make your own anti stress formula for addition to the drinking water or through a water medication system.

[Ask us about anti-stress formula](#)

# Advances in Animal Welfare

## Weaning

### ***Control the stress of weaning.***

- The emotional stress of weaning causes a cascade of hormone and brain chemicals that profoundly affect the animal.
- These cause a depression of the immune system, reduced digestive function and causes disruption of the normal functioning of the heart, respiration and temperature control mechanisms.
- The massive drop in available protein can cause an outbreak of scouring caused by coccidiosis.
- The disruption to digestion causes decreased appetite and feed intake and disruption in rumen function.

### **Managing Weaners**

- You need more than water supplements to manage your weaners health and wellbeing.
- Firstly, provide a good quality oilseed meal or weaner supplement as a supplement to combat the protein drop.
- Provide good quality hay as a roughage source.
- Then provide trace elements, magnesium and a soluble energy source through the drinking water to stimulate the rumen bacteria.



# Advances in Animal Welfare

## Mag Calm

### ***Mag Calm Weaner Stress Water Supplement.***

- This supplement is designed to stimulate rumen function and reduce stress by calming weaners down and reducing the effects of the cascade of hormones and brain chemicals.
- The trace elements stimulate the rumen bacteria.
- Glucose also stimulate the rumen bacteria to digest cellulose.
- Magnesium has a calming effect and reduces the release of brain chemicals that are so harmful.

### **Mag Calm Bag Mix Formula.**

- By using Bag Mix Formula, instead of a premixed product you will enjoy considerable cost savings as well as having greater control over the formulation.
- Our simple Mag Calm Bag Mix Formula uses Trace Elements, Magnesium Sulphate and Glycerol as the main ingredients.
- Other water soluble compounds, such as urea phosphate can also be added to provide extra P for the rumen microbes.

# Advances in Animal Welfare

## Mag Calm

### ***How to formulate Mag Calm plus P on farm.***

- To make 100 l of Mag Calm plus P, Use the formula:
- Trace elements 5 litres
- Mag Sulphate 25 kg
- Glycerol 10 litres
- Urea Phosphate 15 kg
- Water to 100 litres
- Dilute at the rate of 1:100
- Multiply by 10 to make 1000 l

### **Mag Calm plus P Bag Mix Dose rate**

Element	Weaners g/d	Steers g/d
Copper	0.075	0.1875
Zinc	0.129	0.3225
Selenium	0.00792	0.0198
Cobalt	0.00252	0.0063
Iodine	0.00456	0.0114
Magnesium	2.85	7.125
Glycerol	12	30
Phosphorus	3.24	8.1

# Advances in Animal Welfare

## Ginger Oil

### *Ginger is a natural pain relieving compound*

- In human studies ginger has been shown to be as equally effective as paracetamol in giving pain relief.
- This natural compound has a place in giving pain relief to animals, particularly those that have been subject to various procedures.
- Ginger oil can be administered through the drinking water or on feed to relieve the pain and stress of various marking and branding procedures, and because the drinking water provides a continuous dose over several days it is an ideal method of administration

Ask us about how to provide pain relief to your animals



# Advances in Animal Welfare

## Garlic for Buffalo fly relief

### *Flies and Mosquitos don't like garlic*

- Garlic has been used by many producers to help relieve infestations of flies, buffalo flies and mosquitos for many years.
- Big business is not too interested as there is no profit
- Garlic oil is a concentrated natural garlic extract used in animal feeds and supplements to mitigate the negative effect of flies.
- This can be administered through the drinking water or on feed and repel the pesky critters.

[Ask us about how to provide fly relief to your animals](#)





Water Supplements In  
Solution Pty Ltd

# *Rumen Microbes*

Dr Tony Wood

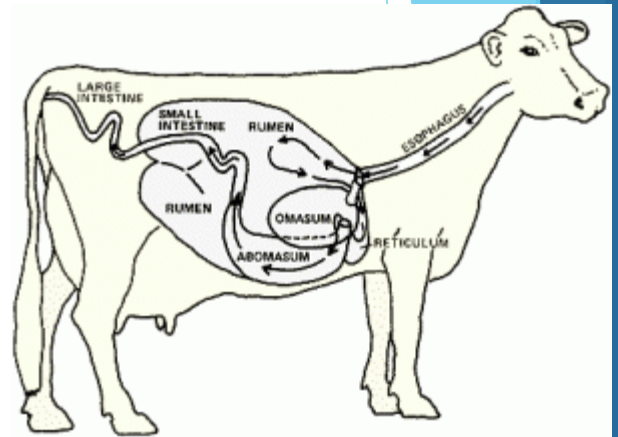
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# Advances in Microbiology

## Feeding the Microbes

### *Feed the microbes – They feed the cow*

The rumen is a large fermentation vat where microbes convert pasture into nutrients the animal can use.



### *Types of microorganisms in the rumen*

- The rumen population is diverse and many organisms work in a symbiotic relationship, the end products of one species becoming food for another.
- They are many different species from the following genera, all contributing to plant digestion.

Bacteria

Archea

Protozoa

Fungi

Mycoplasma

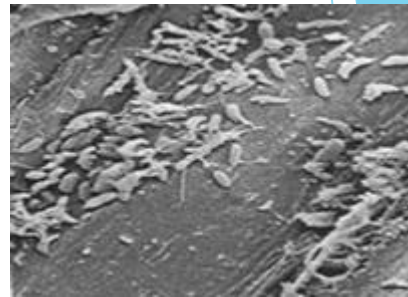
Bacteriophages

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## The Bacteria

### ***Types of Bacteria***

The Bacteria are the most common organisms found in the rumen, making up to 90% of the microorganisms present.



### ***The bacteria are made up of:***

- Cellulolytic Bacteria - Digest cellulose
- Hemi cellulolytic Bacteria - Digest Hemicellulose
- Pectinolytic Bacteria - Digest Pectin
- Amylolytic Bacteria - Digest Starch and sugars
- Acid utilising Bacteria - Digest Acids (Lactic Acid)
- Succinate Users - Digest Succinate
- Formate users - Digest Formic Acid
- Proteolytic Bacteria - Use proteins as the major source
- Lipolytic Bacteria - Digest fats
- Toxin Degrading Bacteria - Detoxify substances (Mimosine, oxalic acid)

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## Increasing Cellulose Digestion

### *Symbiosis*

- There is a symbiotic relationship between different types of bacteria.
- The cellulolytic bacteria require valeric acid, which is only produced by the amylolytic bacteria.
- When valeric acid levels drop cellulolytic bacteria cannot do their job.
- This symbiotic relationship between these bacteria is vital to normal rumen function.
- As a dry season progresses and nitrogen as well as amylose become more limiting, the amylose digesting bacteria cannot produce valeric acid and other growth factors required by the cellulose digesting bacteria and cellulose digestion slows.
- This means that even though there is sufficient energy contained in the cellulose, it is less available due to poor digestion by the cellulose digesting bacteria due to a lack of growth factors and a deficiency of nitrogen.





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## Increasing Cellulose Digestion

### ***Increase Cellulose Digestion***

Glycerol is converted by amylose digesting bacteria to valeric acid and this is used by the cellulolytic bacteria

- It has been shown in *in vitro* studies that the provision of additional sources of substrates to the amylose digesting bacteria, allowing them to produce sufficient quantities of valeric acid and other iso acids, increases the cellulose digestion rate by factors up to three times.
- This has practical implications for stimulating cellulose digestion in the rumen during periods when pasture carbohydrate levels are low. This occurs normally in the late dry season. A practical indication is when the faecal pat starts to mound and become more fibrous.
- By feeding additional carbohydrate sources such as dextrose cellulose digestion can be maximised.

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## Role of Magnesium

### ***Magnesium is a cofactor for enzymes***

Magnesium is an essential mineral that acts as a cofactor in enzyme reactions, including carbohydrate metabolism, protein metabolism, nucleic acid formation and lipid metabolism.

### ***Magnesium is essential for microbe growth***

- Bacteria involved in cellulose degradation have specific requirements for magnesium.
- Magnesium supplementation can positively affect rumen fermentation by promoting the growth of micro organisms and improve the digestibility of feedstuffs.
- This has practical implications for stimulating cellulose digestion in the rumen during periods when pasture carbohydrate levels are low.
- When pastures are fast growing magnesium can be deficient. This can occur in green grass dominant pastures or with cereal crops.
- Lactating cows have a higher demand for magnesium.
- Stress or transport or yarding increases demand.

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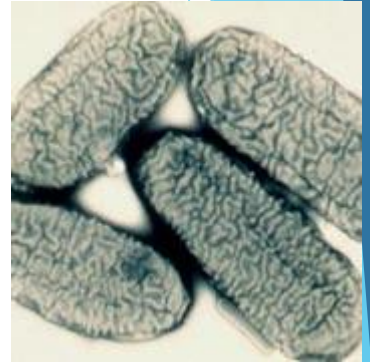
## ***Phosphorus is essential for growth of micro organisms***

- Phosphorus is an essential mineral that is involved in the digestion of cellulose and the synthesis of microbial protein
- Phosphorus is involved in every energy transfer within the rumen microbes and is essential to their function.
- If P levels fall, fermentation rates are reduced and digestibility of organic matter drops. This immediately causes a reduction in dry matter intake and subsequent reduction in performance.
- Water supplementation provides a source of P that is available in the drinking water. This is in contrast to licks where the P is not soluble and must be adsorbed by the cow and recycled through the saliva.
- Microbes in the rumen need approximately 60 grams of available P per day, more than three times the cow requirements.
- Recent observations have shown good responses to P. One herd of 600 head had weaning weights improve by 30 Kg.

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## Probiotics

- The greatest advance in probiotics was the discovery of the bacterium *synergistes johnesii* by Ray Jones.
- This bacterium was able to detoxify the mimosine found in Leucaena plants.



- This steer was suffering from mimosine toxicity after grazing on leucaena.
- The same steer, two months after being given the bacterium was gaining 1.4 kg per day
- Photo: CSIRO – Rob Megarrity and Ray Jones

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## Probiotics

- Probiotics designed to influence production are commercially available.
- They usually consist of a range of micro organisms from the Bacteria, Yeasts and Fungi groups.



- There is not enough scientific evidence to validate the general claims on most products. That's largely because our basic understanding of how probiotics and prebiotics impart health benefits is lacking.
- General claims are usually vague.
- Products for livestock may claim that they enhance the immune system, improve digestive health, maintain or improve intestinal integrity and barrier function, increase feed efficiency and promote growth.

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## Probiotics

Commercially available probiotics usually contain:

Lactic acid producing bacteria

1. Provision of a constant lactic acid supply
2. Adaptation of overall microflora to the lactic acid accumulation
3. Stimulation of lactate utilizing bacteria
4. Stabilization of ruminal pH

Lactic acid utilizing bacteria

1. Conversion of lactate to VFA (e.g., *Megasphaera elsdenii*)
2. Production of propionic acid rather than lactic acid (e.g., *Propionibacterium* spp.)
3. Increase of feed efficiency
4. Decrease of methane production
5. Increase of ruminal pH

Yeasts and Fungi

1. Reduction of oxygen in the rumen
2. Prevention of excess lactic acid in the rumen
3. Provision of growth factors such as organic acid and vitamin B
4. Increase of rumen microbial activity and numbers
5. Improvement of ruminal end products (e.g., VFA, rumen microbial protein)
6. Increase of ruminal digestibility of fiber



# Advances in Microbiology

## Methane Reduction - Agolin

**Reduce methane and increase productivity at the same time with Agolin**

- Agolin, both suppresses methane and promotes animal productivity.



- Research Shows Agolin reduces methane production by about 11%, increases feed conversion by 4 to 7%, reduces ammonia production and increases milk yield by 4 to 5%.
- Using Agolin in Water Supplementation systems is simple. The cost is approximately 6 cents per head per day.
- Apart from production gains, there will be opportunities to register for carbon insets or offsets that will demonstrate your commitment to reducing Methane. There are restrictions about who is eligible to register for the offset scheme. For example, if you are feeding urea or NPN based licks and supplements, you will not be eligible to join.





Water Supplements In  
Solution Pty Ltd

# *Conclusions*

*Let us help you review  
your water  
supplementation  
program*

Contact Dr Tony Wood on 0412167984 to discuss  
how you can start saving on supplements

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# Advances in Supplementation

## Conclusions

### Our achievements at [watersupp.com](http://watersupp.com)

- Advances in hardware continue to deliver safe and precise delivery systems at an economical price.
- Advances in understanding rumen microbe requirements have led to more precise formulations and balancing of ingredients, particularly Phosphorus, Magnesium and Trace elements. This has led to improved results from supplementary feeding.
- Formulations have been modified to reduce the amount of free urea to zero or minimum amounts, making formulations safer.
- The Bag Mix approach to formulations has greatly reduced the cost of inputs.
- The use of Phosphoric Acid in formulation has led to further cost savings and increased flexibility in formulation.
- Greater understanding of animal stress has led to new formulations designed to reduce stress and pain.
- Reduction in Methane can be achieved through water supplementation of registered products such as Agolin.



***Dr Tony Wood has developed the In Solution dose controller and the Formulations described in this book.***

“

*Everyone with controlled water should consider a water supplementation system*

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