

## LET SCIENCE GUIDE YOUR FERTILISER CHOICES

### The Importance of Understanding Plant Science for Greater Efficiency

by Carol Phillips, Executive Consultant Communications and Media

#### WHAT'S IN THIS SPECIAL REPORT

This SR outlines the importance of choosing the right fertiliser for the most efficient, or most targeted and required outcome. This may be for greater crop yield, produce size and quality, plant recovery from deficiency symptoms, to combat or recover from disease or adverse climatic conditions, for productive animal pasture, or to restore organic matter to the soil.

#### UNDERSTANDING THE SCIENCE

RLF's core business is delivering agronomic plant nutrition solutions for all agricultural enterprises whether large and commercial, or small scale and local. For over 25 years RLF has been developing and manufacturing specialty liquid fertiliser solutions for all facets of agriculture, and an extensive body of evidence of the benefits of these fertilisers has been established.

Knowledge of plant nutrition has arisen from the general field of plant physiology. Achieving good responses with fertilisers is therefore predicated on the fact that for all plants – outside of water, carbon dioxide and air – the only other available factor able to influence or increase yield, is nutrition.

And nutrition has traditionally been supplied with fertilisers via the soil.

But there are other means of applying nutrients to the plant as well.



#### The Modern Fertiliser Future

The science has developed extensively over the past few decades, to such an extent that we now have an understanding of the different aspects of nutrient transport, and nutrient requirement, across the whole field of agriculture.

Much more has been learned about every aspect of crop development and how the health of the plant can be supported so that it produces more. It is not only a fact that nutrients give the maximum or required yield, but also that if they are not in balance, and if they are not scientifically formulated, then the plant is likely to suffer from nutrient excess or toxicity. Resistance to disease can also be affected if the nutrient balance is not right.

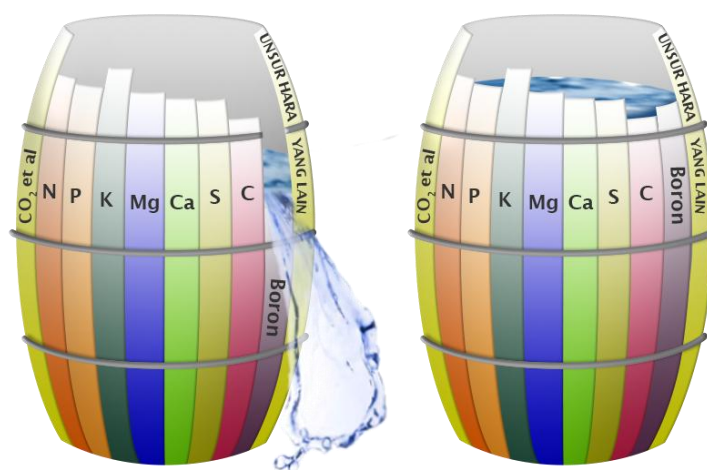
## OPTIMAL BALANCE THE RLF WAY

Because RLF is in the business of delivering agronomic plant nutrition solutions, its products are all targeted, **or optimally balanced** to address a wide range of crop nutrient problems.

By understanding that there is an optimum level for each essential nutrient required by the crop, RLF specialty fertilisers are finding their place in the fertiliser market.

### Optimal Nutrition Explained

In plant nutrition there is a law known as Liebig's law of the minimum. It is based on the premise that a plant is limited by the nutrient that is in shortest supply (in relation to plant need). Once its supply is improved, the next limiting nutrient controls plant growth, and so on. The graphic demonstrates this. A barrel can only hold water up to the height of its shortest stave, and can only be full when all its staves are of the same size. Likewise, a plant can only produce to its full potential when all nutrients are at optimal level (i.e. without any deficiencies or excesses).



### The Three Nutrient Pathways

Agronomic solutions ought to embrace all parts of a crop cycle (being establishment or vegetative phase, followed by flowering or reproductive phase), and all parts of the plant (being seed, leaf and root).

The three nutrient pathways of seed, leaf and root are especially potent if considered in a holistic way. And, to a certain extent this has generally been neglected in the past.



Seed nutrient levels, and especially the role of phosphorus, determine crop yield, so by fertilising the seed prior to sowing gives it advantage from the very start of the crop's life cycle.



Broad-spectrum foliar spraying through the leaf is another very natural way of delivering nutrition, which effectively allows it to bypass any nutrient unavailability in the soil that often limit growth. That however, is only one feature of foliar spraying. There are other important aspects as well. The impact that broad-spectrum nutrition has on the root system is a powerful one.



It promotes the quick and vigorous growth of the roots enabling them to explore further and deeper into the layers of soil to reach moisture and soil-based nutrients. This in turn promotes a rhizosphere rich in microbial activity which is mutually beneficial for both plant and future soil health.

So, optimally balanced products, providing optimally balanced access via all nutrient pathways is the RLF way – all based on plant science.

## THE EMERGING ROLE OF SPECIALTY FERTILISERS

*Markets & Markets* recently commented on the role of specialty fertilisers in delivering agronomic plant nutrition. They said:

*"Developing economies (across Asia) are increasingly aware of the many benefits of specialty fertilisers. They include:*

- *enhanced efficiency technology*
- *ease of application*
- *reduced application costs*
- *increased agricultural productivity*
- *more efficient nutrient uptake in plants*
- *reduced potential for nutrient losses to the environment*
- *low impact with resource and labour-saving attributes"*

It is by taking a holistic approach to plant nutrition that RLF specialty products are being advanced.

It is this approach that delivers maximum impact and return, and the science-based evidence is growing to support this aspect of crop nutrition.

## THE SCIENCE OF THE SEED

The importance of fertilising the seed with RLF seed priming technology is based on science.

It is very different from seed coating processes which farmers have generally relied upon to give nutrient advantage to the seed at sowing time.

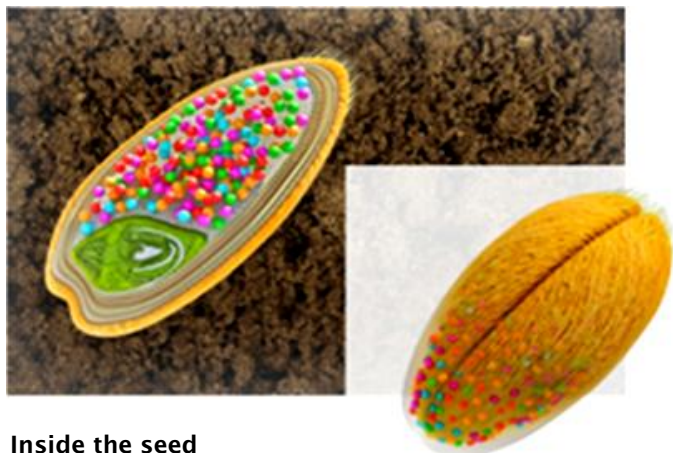
**The importance of fertilising  
the seed  
is based on science**





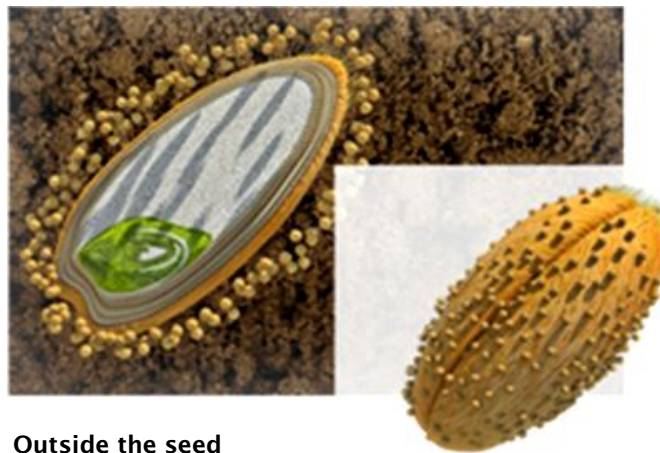
There are technical differences to these two processes that can be summed up as follows:

## Seed Priming



Inside the seed

## Seed Coating



Outside the seed

### ■ Seed Priming

This advanced practice relies on the imbibing process which delivers a fully balanced broad-spectrum liquid solution of all essential elements directly to the seed. These balanced nutrients improve the performance of the seed because once imbibed, nutrition is available to the seed for its **immediate use**. It then continues to be available to the plant, via the seed, during the early weeks of growth and development.

### ■ Seed Coating

This practice relies on the seed being coated with a suspension containing one or two elements, however the coated nutrients remain too far from the root exploring sphere, since primary roots generally go down vertically without ready access to the nutrients that are attached to the seed coat. Moreover, there is no direct improvement in seed nutrient levels because of this process. Any seed that is nutritionally suboptimal from the start will remain that way, with the result of lower crop yield when compared to that of a primed seed.

Seed priming as developed by RLF has unique characteristics.

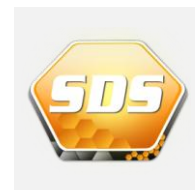
- It is acid.
- It is high in phosphorus.
- It contains the full range of essential trace elements.





## The Key Benefits

The key benefits delivered by this advanced seed priming delivery system (abbreviated to SDS) include:



**Seed  
Delivery System**

### 1. Elevate Nutrients

The level of essential elements in the seed are elevated to above optimum level. This ensures the maintenance of adequate nutrient in the seed because all nutrients are safely transported inside the seed to be utilised by the embryo.

### 2. Set for Maximum Yield

The broad-spectrum nature of the nutritional solution means maximum yield potential is set, and that it does not miss out on establishing this response due to suboptimal grain nutrient levels.

### 3. Direct Effect on Yield

It has a direct effect on yield since 100% of the nutrients contained within it are absorbed by the seed. Because it is very common for nutrient levels in untreated seeds to be at suboptimal levels, RLF's seed priming technology has undergone rigorous scientific testing to demonstrate improvement to the seed's internal nutrient concentrations.

### 4. Rich in Plant-available Phosphorus

It is rich in plant-available phosphorus which directly influences yield potential regardless of the fertiliser rates applied to the soil. Therefore, a direct effect on yield can be achieved through seed priming.

### 5. Override Soil-based Deficiencies

Unlocking soil-based phosphorus with this seed technology is highly practical. Whilst trace element deficiencies such as zinc and manganese can be easily overcome with in-season foliar spraying, the same is not true for phosphorus deficiency. If phosphate availability is not good, crop yield potential would not be recovered by a similar in-season application of phosphorus. By providing inorganic phosphorus from the first day of the seed's life, a strong plant development and higher yield potential is established.

### 6. Maintain Soil Health

The impact of continuous cereal cropping also gives rise to increased soil pH over time. As a consequence, it depletes the availability of metallic trace elements and phosphorus. Seed priming technology overcomes these soil deficiencies.

By using the science of the seed, RLF has been able to engineer and manufacture seed priming fertilisers that represent innovative and advanced technology. Fertilising the seed is very efficient and can often be done with other routine farm practices such as the application of crop protection chemicals or treatments.



## THE SCIENCE OF THE LEAF

Every crop and every plant has a different trace element nutrient need.

RLF recognised this as a major issue for farmers and growers, and with the science of plant physiology and nutrition at its core, engineered highly concentrated liquid crop nutrition products designed to change the way in which nutrient was delivered to the plant so that nutrient deficiency issues were better managed.

It is often only when deficiency symptoms reveal themselves that farmers know they have a problem that is going to have a marked effect on a crop's health, yield potential and value. And sometimes this realisation comes too late. RLF's science-based approach can change this scenario.

It uses the science of the leaf to facilitate delivery of nutrient rich foliar applications in a safe, stable and optimally balanced way.

With a technically engineered nutrient delivery system (abbreviated to NDS), RLF products guarantee the safe transfer of nutrients straight through the leaf wall to be directly absorbed by the leaf cells. This significantly improves productivity because the nutrient is readily moved – or translocated – within the plant through the increase in the plant's photosynthetic efficiency. This enables more effective assimilation of the nutrient elements for the plant's immediate use.



**Nutrient  
Delivery System**

The NDS simplifies the science and agronomy associated with the nutrition of each crop type and helps deliver the important information necessary to achieve balanced crop nutrition. It is an effective way to achieve maximum crop yield. The NDS also acts as a carrier into the plant cell without causing any damage to the cell. This means that nutrient elements can be safely transferred into plant cells, and then become mobile via the cells to the functionaries of the plant. This is a major shift for the delivery of essential elements for crop growth and health, which traditionally relies on nutrients being transferred through the leaf via the stomata.

Farmers need efficient nutrient delivery, because crop yield is influenced by plants being able to access the required amount of each nutrient it needs in a balanced and timely way. Access to the essential elements required at different phases of a crop's development is also crucial for high-value performance and outcomes.

**Access to the essential elements  
is crucial for high-value  
performance and outcomes**

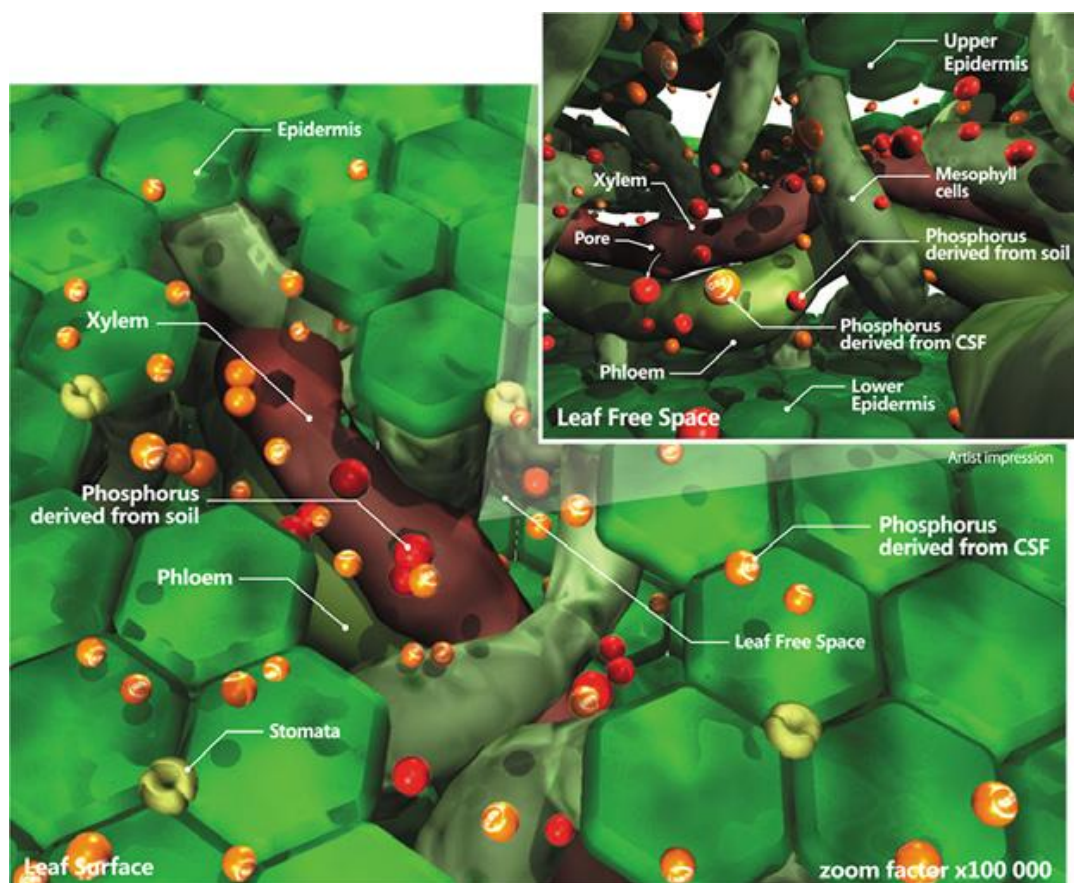


However, high levels of a particular nutrient in the soil can often interfere with the availability and uptake by the plant of other nutrients. Those nutrients that interfere with one another are said to be antagonistic. RLF has engineered technology that neutralises the antagonistic effects that elements can have with one another, and this is an advanced technological solution to this problem. With this technology, specifically formulated foliar products with twelve or more elements, can be delivered to the leaf in one stable solution that supplies adequate and balanced nutrients to the plant.

## Safe Transfer of Nutrients Explained

RLF's core Ultra Foliar products provide the safe transfer of nutrients straight through the leaf wall to be directly absorbed by the leaf cells.

This significantly improves productivity because the nutrient is readily moved, or translocated, within the plant through the increase in the plant's photosynthetic efficiency. This enables more effective assimilation of the nutrient elements for the plant's immediate use.



This is a shift for the delivery of essential elements, which traditionally relies on the nutrients being transferred through the leaf via the stomata.

## What Farmers Already Know

They understand that:

- As much as 60% of crop yield is dependent upon nutrient availability.
- Crop nutrition is the foundation of a healthy and productive harvest.
- Crop nutrition science and research advances and changes at a rapid pace, so it is important to be informed and have access to modern technologies.
- Optimum growth environments do not sustain themselves, and a crop nutrition program should be managed throughout the entire year.
- The vagaries of climate can impact the health of the crop, therefore crop nutrition becomes an even more important tool for mitigating these effects.

RLF nutrient delivery through the leaf walls directly to the leaf cells facilitates this need in the most efficient and safe way.

## THE SCIENCE OF THE ROOT

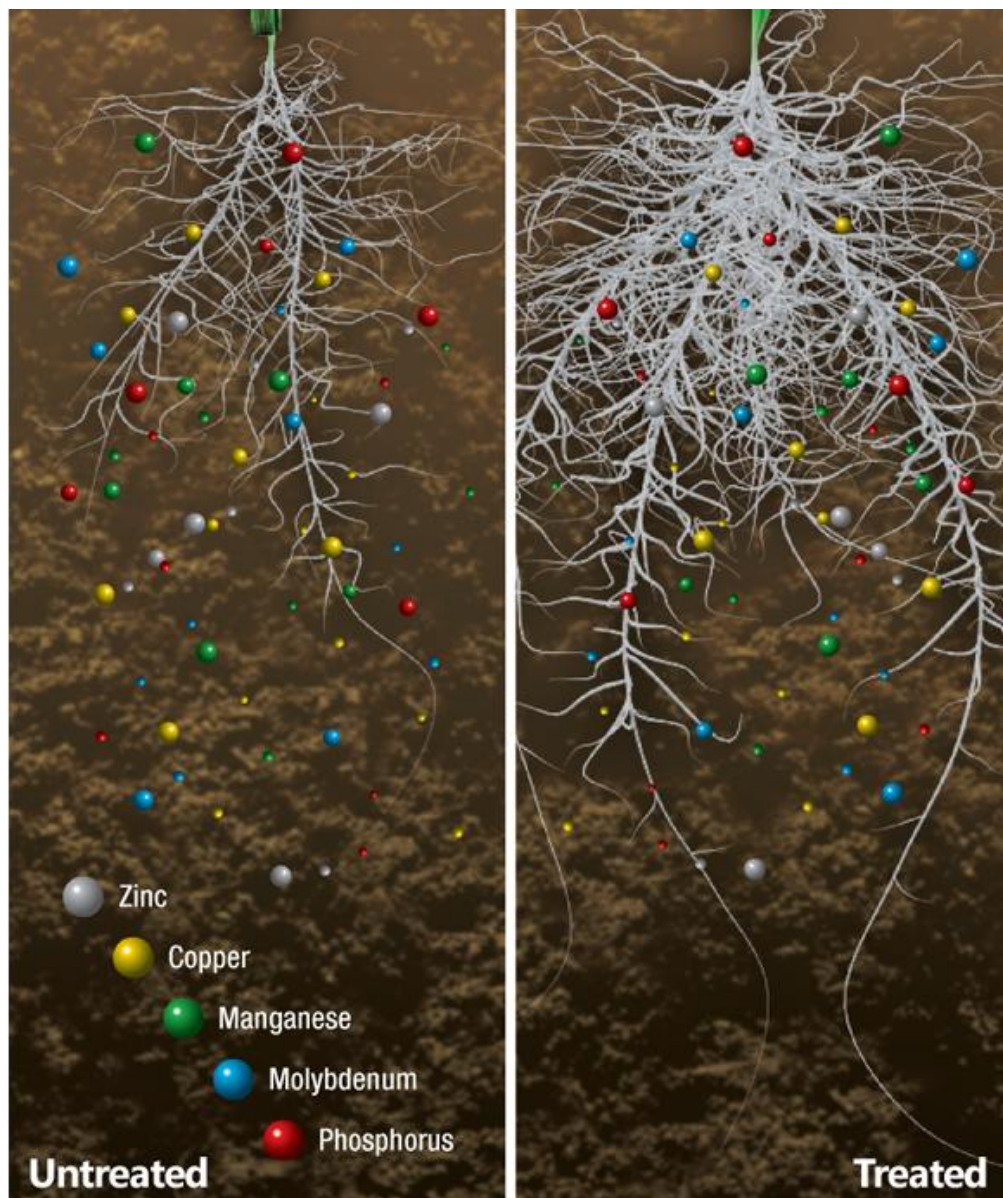
Root growth responds to the types and levels of nutrient it is able to access in the soil.

Whilst it is beneficial for a plant to grow a strong root system, it is equally important to maintain good balance between its root and shoot growth so that the shoot is not deprived of nutrient at the expense of the root. The levels of nutrient in the soil determines the reactions or responses of root growth that then move through the root system to the leaves or top-growth of the plant. This is why it is essential to balance the level of nutrients in the soil to get the optimum level of growth needed for the root.

Early root growth aids quicker seed establishment, and agronomically will always be beneficial for avoiding diseases and for establishing better in harsher growing environments such as extremes of heat and cold.

The root system is the engine room of the plant, and if supported appropriately will form a healthy rhizosphere.

### Healthy Root Mass Explained



This is the zone of soil immediately surrounding the root of the plant, in which the chemical reactions and microbial activity takes place to change the ratios of beneficial organisms when compared with the surrounding soil.

A healthy root mass has a substantially higher number of fine root hairs, and this in turn gives an exponentially larger root surface area.

As a result, roots have a rich, bulky and healthy rhizosphere created by the larger root surface area which generates plant exudate.

**The root system  
is the engine room  
of the plant**



In turn, this exudate provides the host for stimulated microbial activity (or mineralisation) where the conversion of soil-based organic matter into inorganic plant available nutrient occurs. Mineralisation is the chemical action that unlocks the phosphorus to make it available to the plant.

This action ensures that the plant has access to 'available' phosphorus, and more phosphorus means greater crop yield. It also means that more organic matter returns to the soil for future crops, and this is a significant and sustainable benefit.

So, several beneficial physical effects and outcomes are achieved by this turbo-charging of the root system. It is a sequence of 'cause and effect' outcomes understood through the science of the root and soil that delivers benefits such as:

- increased early vigour
- strong plant growth with early tillers that are more viable
- tolerance to drought and water logging
- greater phosphorus activation and improved uptake from the soil
- improved granular fertiliser performance
- improved nitrogen efficiency in the plant
- better resistance to disease
- greater tolerance to environmental impact or extremes
- improved plant metabolism

RLF crop nutrition products, and particularly if used as part of an integrated fertiliser program, are designed to promote root development and growth.



Plant physiology and soil science informs the technology that underpins the entire RLF product range.



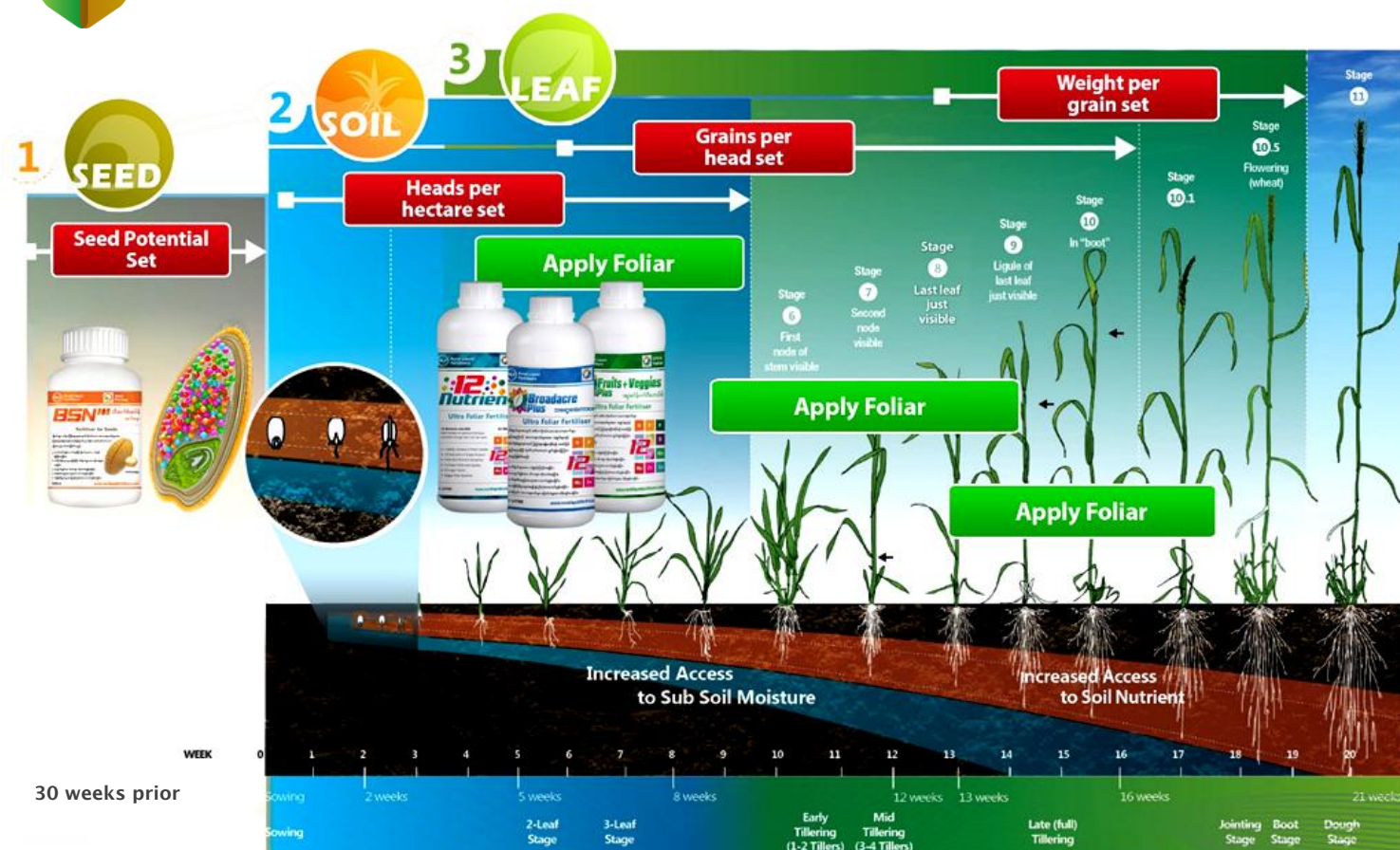


## THE SCIENCE OF A FULLY INTEGRATED APPROACH

RLF promotes Integrated Fertiliser Management (IFM), which is the term used to describe the process in which nutrient levels in the soil, seed and leaf are managed synergistically to improve overall fertiliser performance and water use efficiency. This has been proven through many evaluation trials to deliver better crop quality and yield outcomes.



### Integrated Fertiliser Management



The impacts include improvements and efficiencies such as:

- a potential reduction in the amount of granular fertiliser required to help offset the seed and foliar fertiliser product costs
- greater potential for crop quality and increased yield
- greater reliability of crop performance
- more efficient water use and beneficial return of biomass to the soil
- increased plant strength and health





This success however depends on four basic functions, all considered crucial to the practice of IFM.



Treating seeds with a Seed Priming fertiliser (such as **BSN Superstrike**) to raise phosphorus and trace element levels to optimum, or above optimum levels. This enables seedlings to set a higher yield potential, form greater root exploring ability and to better resist stress and disease.



Applying nutrient to the soil – usually as granular N-P-K – at optimum, **but not excessive** levels. This is determined by fertiliser history, soil test and potential or expected yield.



Using Ultra Foliar fertiliser (such as **Broadacre Max**) to provide up to 12 essential nutrients to the plant in the most effective way. This avoids 'hidden hunger' and future unseen yield losses. This can be achieved by using specially formulated Ultra Foliar fertilisers (of which there is an extensive product range) to extend the momentum of root efficient exploration and supply essential nutrient to the plant.



Not jeopardising these functions by soil applications in excess of crop demand, and by only applying moderate NPK input and stepwise nitrogen applications.

## Example Success Stories

### Brittas Evaluation Trial, Canowindra, NSW



### Erangy Springs On-farm Trial, Midwest, WA



## Why Choosing IFM is Important

Crop quality and yield is becoming increasingly more important as the world population grows and the viability of some agricultural lands decrease with overuse or over-management.

Farmers and growers everywhere are looking for crop advantage. However, they are also looking for healthier soils and future sustainability advantage too.

IFM supports all of these crucial outcomes:

- ✓ it minimises risks and maximises opportunities for cropping success and increased yield
- ✓ it ensures input costs are invested in the best areas to drive home the best yield
- ✓ it gives the opportunity to reduce traditional input costs by channelling just 10-20% of the fertiliser budget into modern farming products
- ✓ it adopts new farming practices based on plant science and advancing technology for more efficient and beneficial products
- ✓ it provides the advantages of the latest high-performance products available
- ✓ it applies plant science principles by establishing new nutrition practices involving fertilising the seed (95% effective) and applying high performance Ultra Foliar (80-85% effective) in support of the less effective, but required methods (a soil granular regime of 15% effectiveness)
- ✓ it gives opportunity to increase the quality and health of crops and produce
- ✓ it gives opportunity to increase crop yield
- ✓ it can deliver better financial returns
- ✓ it improves the quality of the soil through the return of nutritious organic biomass so that it can continue to support farming and agricultural business enterprises for years into the future



**It is a modern, scientific approach.**

**It is a program rigorously researched to improve crop performance and increased yield.**

**It is for these reasons that IFM is important.**

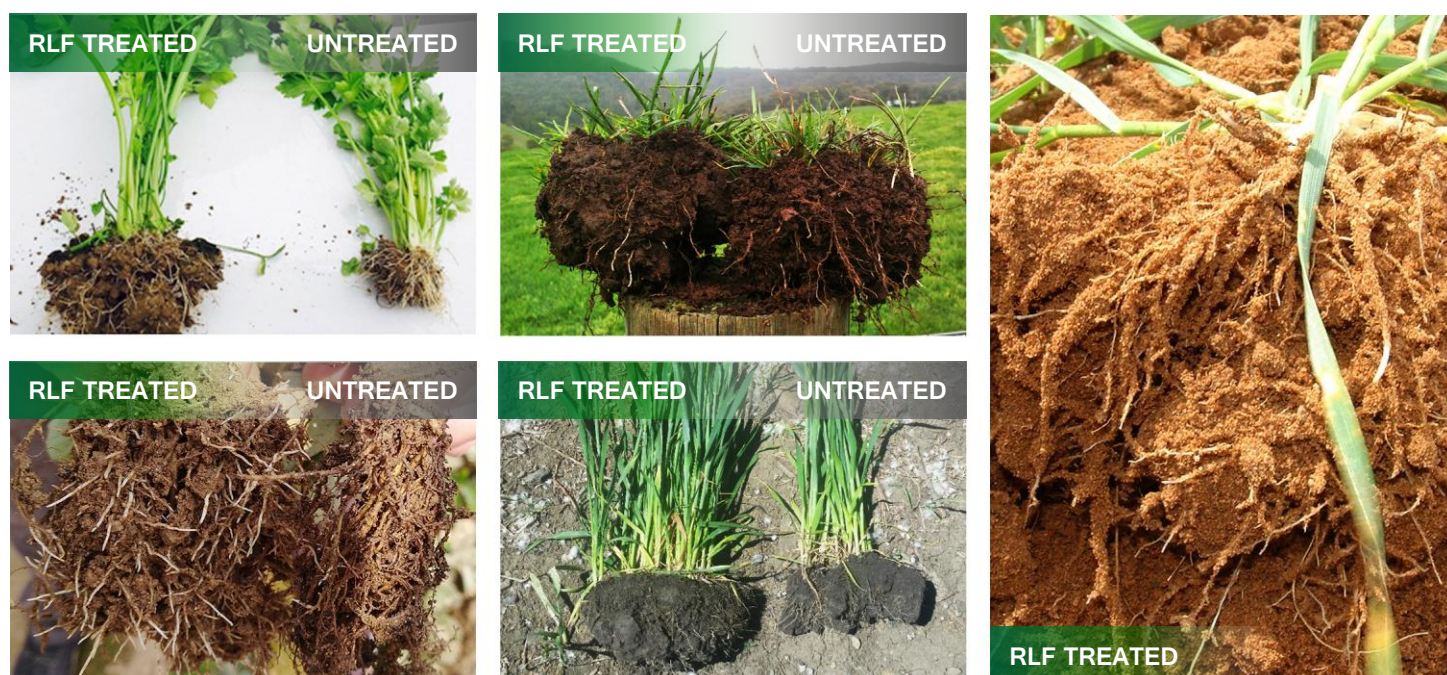


## Add Value to Your Soil because of RLF's Scientific Approach

RLF products can lead to more high-value biomass for the future of viable agriculture by stimulating greater microbial activity (or mineralisation) for improved conversion of soil-based organic matter. Helping build natural soil fertility that gives back to the soil.

This promotes the sustainability of arable land and cropping environments for future generations.

With an integrated approach to fertiliser practice, RLF's key seed priming and foliar products can increase the nutrient value and biomass of root systems in tandem with the quality of above-ground plant matter. Following harvest, the plant matter reverts nutrition to the root biomass that in turn directs nutritional value back to the soil ready for the next crop.



## SUMMARY

By taking a big-picture view of how a product is researched, tested and formulated brings many advantages.

RLF's IFM approach in particular, with its specialised products for fertilising both seed and foliage consistently demonstrate its value and worth through the many trials and other evaluations (whether field or laboratory-based) conducted by our staff team in marketplaces all over the world.

RLF shows its commitment to the agricultural world through its world-leading products and looks forward to the future with confidence.

It knows that its customers can share this same confidence in the products they manufacture, as they are all based and formulated on the science of both plant and soil.