WHAT IS A FERTILISER? – *A BRIEF OVERVIEW*

Introduction

Fertilisers are nutrients fed to plants to promote growth and provide greater harvested yields. Fertilisers contain mineral elements essential to plant growth & are applied to compensate for deficient soils &/or nutrient depletion caused by the removal of plant products or by leaching or gaseous loss. They are usually applied either via the soil, for uptake by plant roots, or by foliar feeding, for uptake through leaves. Fertilisers can be organic (composed of organic matter, i.e. carbon based), or inorganic (containing simple, inorganic chemicals). They can be naturally-occurring compounds such as from mineral deposits, or manufactured through natural processes (such as composting) or chemical processes (such as the high petro-chemical dependent Haber-Bosch process which results in the artificial synthesis of Ammonia, which can then be used to manufacture Urea & ammonium nitrate).

Fertilisers generally supply, in varying amounts, the three major plant nutrients (the macro-nutrients N-P-K = nitrogen, phosphorus, and potassium). Some fertilisers may provide secondary plant nutrients (calcium, sulfur, magnesium), and occasionally even some trace elements (or micronutrients) which also have a role in plant nutrition (such as: boron, chlorine, manganese, iron, zinc, copper and molybdenum).

The balanced application of fertilisers can considerably increase the harvested yield per hectare and the sustainability of land. However, if an “unbalanced” amount of fertiliser nutrients is applied or if “too much” fertiliser is used (e.g. excessive amounts of N), there is a risk of unbalancing and/or *over*-fertilising the soil and this in turn may cause lockup and “bio-*un*availability” of essential nutrients, along with other adverse effects. Likewise, the use of totally water soluble fertilisers can lead to excessive leaching (e.g. loss of the nitrates and phosphates into the groundwater). Comprehensive cation exchange soil testing can help determine the levels of mineral nutrients and their balance in the soil, and assist in deciding which minerals and how much should be applied to enhance the performance of a crop.

Mineral Fertiliser *(Microbe Controlled-Release Fertiliser)* vs *Acid Soluble* Fertiliser *(Chemical Fertiliser)*

The term “Mineral” fertiliser (sometimes called “Silicate based Mineral”, “Biological Mineral”, “Biologically-friendly Mineral”, “Mineral RICH” or “Mineral EN-RICHED” fertiliser) is used *to differentiate from* **“artificial High Analysis” fertilisers** (which include “acid”, “acidified”, “soluble”, “chemical”, “synthetic”, “conventional”, “NPK”, “macro-nutrient” or “inorganic” fertiliser).

Mineral fertilisers basically consist of a combination of fine mineral ores in their "natural state" (such as micas, alkali feldspars, soft rock phosphate, potassium silicate etc), which are rich in silica and can contain up to 65 essential multi-nutrients (P, K, Mg, Ca, Si, Trace Elements etc). **These nutritionally important minerals can become bio-available through *microbial activity* on the "natural" ores by certain beneficial microbes.** For example, Mycorrhizal fungi are highly efficient at solubilizing and extracting minerals from the ores, and exchange some of these nutrients with host plants, thereby forming a mutually beneficial symbiosis.

Acid soluble fertilisers are chemically treated to make the nutrients *soluble* in water. For example, rock phosphate is predominantly calcium phosphate $Ca(PO4)_2$ (which *is not sufficiently water-soluble* to be used as a "conventional" fertiliser). The addition of acid such as Sulphuric acid converts rock phosphate into a *water-soluble* "superphosphate" form - calcium dihydrogen phosphate $Ca(H_2PO_4)_2$ + $CaSO_4$. Similarly, rock phosphate can be reacted with orthophosphoric acid to produce water soluble "triple superphosphate" (P_2O_5 no S). **Hence - the term *"acid fertiliser"*.** Silicates are generally removed as silicon trifluoride from these types of acidified fertilisers.

Acid fertilisers rely on direct contact with the plant root system for uptake and because of their losses due to mobility, volatility and tie-up, higher analysis amounts are required to meet the plant requirements.

On the other hand, ***Mineral fertilisers <u>are not</u> treated with acid*** and therefore have a more neutral to alkaline pH (approx pH 7-8.5). WMF consciously selects alkaline inputs to buffer the acid affects of the chemical fertilisers as well as various environmental constraints (such as low soil pH and Aluminium), subsequently they can be blended with acid fertilisers to produce a more neutral product.

Salt index (**SI**) is a measure of the salt concentration that fertiliser induces in the soil solution. ***Acid soluble fertilisers*** tend to have a higher **SI** than ***Mineral fertilisers***. When applied near the seed, fertilisers with lower **SI** values generally cause fewer problems in seed germination or seedling injury.

The value of Biologically linked Fertilisers

19th century Chemist Justus von Liebig contributed greatly to understanding the role of inorganic compounds in plant nutrition & devised the concept of **Liebig's barrel** to illustrate the significance of inadequate concentrations of essential nutrients. However, he deemphasized the role of **humus** & *completely missed the beneficial role of* ***<u>microorganisms</u>***. This theory was influential in the great expansion in use of ***artificial high analysis fertilisers*** in the 20th century.

Most soils in Western Australia are very ancient, highly weathered and deficient in many of the major nutrients and trace elements. Added to this, ***Acid soluble fertilisers*** generally do not replace trace mineral elements in the soil, which become gradually depleted by crops grown and harvested. Studies have shown a marked fall (up to 75%) in the quantities of such minerals present in fruit and vegetables.

2/…

Mineral fertilisers on the other hand are *silicate-rich*, "natural" ore based, usually containing up to 65 different minerals, all of which are selected for their advantage to beneficial soil biology. Mineral fertilisers in agricultural settings are resulting in excellent crop and yield performance, and research in this area is now shifting *from* simply replacement of high analysis fertilisers *to* their role in improving soil health. Microorganisms play an important role in the weathering of silicate minerals and mineral ores, and in turn the minerals appear to play an important role in microbial ecology, and in plant nutrition and grain quality. In general, any one mineral (when deficient or totally absent from the soil) can be limiting to plant growth. An example of an important plant-growth limiting factor is Phosphorus, which can be absent or locked-up in WA Aluminium-dominated acid soils (Hayman 1983, Harley & Smith 1983, Marschner 1995, Bolan 1991). Biology (in particular Mycorrhiza) have the potential to by-pass soil constraints (such as tie-up of P by Aluminium) and provide Phosphorous and other essential nutrients to the colonized plant. In addition, silicate minerals may also take on the role as de-facto organic matter as an addition of silicate minerals can increase water holding capacity, cation-exchange capacity and thus nutrient cycling.

Acid Soluble Fertilisers

- Highly soluble requiring close placement to root system.
- Have an acidifying effect on the soil by two functions - (i). the fertiliser is acidic
  - (ii). has an acid reaction in the soil.
- Requires higher analysis due to losses by leaching, volatility and tie-up within the soil.
- In many cases has a negative effect and negative impact on beneficial soil biology and ecology.
- Can create serious mineral imbalances with in the soil.
- Not sustainable in the long term.

Mineral Fertilisers

- A Silicate-rich alkaline to neutral combination of soluble and ore based fertiliser.
- Slow-release compound granule for use in conventional seeding and spreading equipment.
- A comprehensive natural source of up to 65 types of soil minerals & trace elements.
- A regenerative agent to depleted soils and growing media
- Remineralises the soil and can buffer the acidity of the chemical fertilisers.
- Promotes optimal soil fertility and root development.
- Stimulates beneficial soil biology.
- Sustainable and environmentally friendly with no/minimal leaching into ground water.
- Non-toxic and safe to aquatic animals and plant-life.

Using Mineral and Acid Fertilisers Together:

When 'synthetic' and 'mineral' fertilisers are used in tandem, more *efficient* use can be made of the soluble component of the fertiliser. Better crop response has been observed (Fenchel *et al* 1998) because the mineral fertiliser encourages the living aspects of the soil, and helps negate the adverse effects of 'synthetic' fertilisers. Because mineral fertilisers are a long-term proposition, they will continue to realize improvements in the soil. The soil can therefore maintain maximum nutrient availability to feed the crop, as it is required.

Western Mineral Fertilisers BASAL FERTILISER:

The mineral fertiliser is a compound (each pellet contains all the mineral combination) and granulated for use with standard seeding and spreading equipment with application rates similar to Acid soluble fertiliser.

Contains inputs predominantly of *ore-based origin* and *may* include:

- **Potassium/Mg/Ca Silicates, Soft Rock Phosphate, Potassium Sulphate, Dolomitic clays, Lime, Gypsum, Volcanic Minerals & mined Trace elements.**
- **Organic Carbon (Lignite)**- selected for its neutral pH with high Humates and available Fulvic Acid, which are significant in buffering toxicity in soils and increasing nutrient absorption by plants.
- **Nitrogen and Phosphorus** nutrients (both in natural and soluble form).
- **Minor and trace minerals** in both quick and slow release forms, including Calcium, Sulphur, Magnesium, Manganese, Zinc, Copper, Selenium, Cobalt etc etc.
- **High Cation Elements** - which helps tie up aluminium. These fertilisers are not acidic and contain the basic cations for reducing soil acidity.

Results of Western Mineral Fertilisers Programs:

The use of the WMF mineral fertiliser and biological programs has resulted in improved plant growth, harvest yields and quality; while enhancing plant cuticle strength, plant dry weight & root development (…refer to WMF trial data).

There are noticeable improvements in soil mineral balance, soil organic mater levels and soil biological function - which has resulted in better Phosphorus availability, more stable nitrogen growth and overall enhanced effectiveness of the fertilisers.

Head Office
Tenterden PO 6322 WA
Phone: (08)-9851-7222
Fax (08)-9851-7293