The Benefits of Using GrowGreen's Soft Rock Phosphate

Phosphorus

Phosphorus is one of the 17 chemical elements required for plant growth and reproduction, is often referred to as 'the energizer' since it helps store and transfer energy during photosynthesis. It is also part of the genetic material of all cells—DNA and RNA. The symptoms of phosphate deficiency in plants include:

- Red or purplish colour (anthocyanin pigment) in leaves, especially undersides;
- Death of tissue or necrosis may follow and root growth is poor;
- Lower stems may be purplish. Plants may exhibit stunting and delayed maturity;
- Loss of water from lower leaves and it may exhibit reduced flowering.

From: (Buddh, 2014).

Phosphorus deficiency can also slow down carbohydrate utilization. Table 1 shows the amount of phosphate removed by different crops and the need to consider phosphate in crop nutrition planning. Phosphate is needed by all crops (see Table 1), but is particularly important for oilseeds such as canola and sunflower. There is however a real concern over the use if inorganic phosphate fertilizers and a real need for a cheap, natural and more environmentally friendly alternative.

1. *Phosphate Requirements of Different Crops*

	kg P_2O_5 needed per tonne of yield
Cereals	8.46
Rice	11
Maize	9.37
Chickpea	9.33
Pigeon Pea	15
Peanut	16
Soybean	25
Canola	28.8
Sunflower	24.8
Potatoes	1
Sweet potato	1.72
Sugar cane	1.5
Sugar beet	5
Cotton	14.4
Pasture	8

From: (Roy, et al., 2006).

What is Soft Rock Phosphate

Rock phosphate, phosphorite or phosphate rock is a non-detrital sedimentary rock which contains high amounts of phosphate bearing minerals. Soft rock phosphate is a clay material, which increases the cation exchange capacity of the soil which allows the soil to hold more positively charged nutrients such as; calcium, potassium, magnesium and trace elements. In addition to phosphate soft rock phosphate many other trace elements such as silicon, manganese and sulphur are present in rock phosphate (Chen & Graedel, 2015).

Key Advantages of Soft Rock Phosphate Fertilizers

- Soft Rock Phosphate is less expensive than conventional inorganic phosphate fertilizers e.g. DAP (Diammonium Phosphate), MAP (Monoammonium Phosphate) and TSP (Triple superphosphate).

- Soft Rock Phosphate is a beneficial source of carbon for improved plant energy and beneficial bacterial and microbial populations.
- Soft Rock Phosphate is beneficial for acid soils because of its high calcium content that aids in neutralizing acidic soils. Phosphate rock has approximately one fifth the neutralizing power of lime.

Soft rock provides benefits to crops by encouraging growth of soil bacteria and earthworms and unlike many other nutrients it remaining in the soil until used by the plants without leaching. It also contains calcium, iron, boron and a good supplier of silicon. It is good to add to the compost heap and a great addition, along with other soluble nutrients, as a liquid fertilizer.

Like hard rock phosphate soft rock is not a complete fertilizer and is usually used along with other nutrient sources to create a custom fertilizer, the use of soft rock phosphate with GrowGreen's other microbial fertilizers is ideal.

GrowGreen's Soft Rock Phosphate (SRP)

GrowGreen's Soft Rock Phosphate is a clean source of phosphate from Australia with low levels of impurities and contaminants that can be used with confidence. GrowGreen's SRP is a fine odourless, powder with a small particle size (over 80% of particles <250 microns) providing great solubility. The product is safe and easy to use on its own or with all other GrowGreen microbial fertilizer products.

What is in GrowGreen's SRP?

Like any natural substance soft rock phosphate contains a range of elements, some beneficial, others potentially harmful to plants. Applications of phosphate fertilizer can contribute to the build-up potentially hazardous trace elements such as arsenic, cadmium, and lead in croplands, therefore it is essential to look at the exact source of any phosphate fertilizer used and the micronutrients and other elements present.

2. *Range in concentration of potentially useful and harmful elements in phosphate rock*

Potentially useful elements	Range of concentration (mg/kg P)	Potentially harmful elements	Range of concentration (mg/kg P)
Cobalt	5–42	Arsenic	30–150
Copper	104–756	Cadmium	0.9–600
Manganese	50–2 500	Chromium	6–4 600
Molybdenum	20–70	Lead	7–180
Nickel	11–590	Mercury	0.2–12
Selenium	15–213	Thorium	28–1 528
Zinc	35–6 040	Uranium	49–1 100
		Vanadium	25–5 660

From: (Roy, et al., 2006), page 308

Fertilizers can be adulterated products containing raw material sometimes from unknown and/or questionable sources. Besides the certified nutritional ingredients for plants, they may contain, most notably, trace elements contaminants that can be inadvertently introduced into soils. E.g. cadmium is a toxic element often present in rock phosphate and some sources have been banned for high levels of cadmium and other toxics. Cadmium is the most toxic of all the heavy metals. It has a tendency to accumulate in both leaf and root vegetables and can contribute to serious health problems for livestock and humans.

The potential risk from cadmium in organic fertilizers is a growing concern in many countries, for example from 2022 the EU will introduce a new limit on the content of cadmium in phosphorus fertilisers which will be set and implemented at 60 mg/kg and further reductions of the cadmium content may be introduced through a review clause in the regulation text (Organic Market Info, 2019).

A musical analogy is useful here. Soft rock music is gentle and appealing to many but the heavy metal, head banging alternative is counter-productive for both health and well-being.

GrowGreen's SRP contains minimal levels of cadmium making it a soft rock phosphate source that can be used with absolute confidence.

When choosing a soft rock phosphate you need to ensure that you choose a clean source, small particle size and high in soluble phosphate and low in toxic elements such as cadmium. Analysis has shown that GrowGreen's Rock Phosphate is a clean phosphate source with low levels of heavy metals (e.g. minimal levels of Cadmium) and other contaminants (See Table 3).

3. *Analysis of GrowGreen's SRP*

Laboratory Analysis By Southern Cross University and SWEP Analytical Laboratories						
Nitrogen	%	0.1		Iron	ppm	7,555
Phosphorus	%	16.0		Manganese	ppm	439

Potassium	%	0.0		Zinc	ppm	2
Sulphur	%	0.1		Copper	ppm	26
Calcium	%	30.4		Cobalt	ppm	2
Magnesium	%	0.3		Boron	ppm	0
Sodium	%	0.1		Molybdenum	ppm	0
				Silicon	ppm	4,275
				Aluminium	ppm	3,236
pH		8.5		Selenium	ppm	7
Moisture	%	6.0		Cadmium	ppm	<0.5
Mercury	ppm	<0.1		Arsenic	ppm	16
Silver	ppm	<1		Chromium	Ppm	<2
Fluoride	ppm	2,400		Nickel	Ppm	<1
Citrate Soluble Phosphorous[1]	%	4.0		Lead	Ppm	<1

[1]Analysis by SWEP Analytical laboratories

The phosphorus content of GrowGreen's SRP is 16% which means a P_2O_5 (phosphorous pentoxide) content of 36.7% (the phosphorus content of P_2O_5 is 43.642%[1], = (16 x 1/43.642) x 100 = 36.7%). Citrate soluble phosphorous makes up 4.02% of the total content of providing an available phosphate content of 9.2% (4.0% x 1/43.642) x 100 = 9.2%). We recommend 250 kg rock/ha providing 23 kg of P_2O_5 /ha.

GrowGreen's SRP is more than just a clean phosphate source. In addition to phosphorous GrowGreen's SRP contains a number of other beneficial micronutrients. This includes a high level (+30%) of calcium which works as a soil amendment loosening tight soils and improving soil tilth. Calcium also helps to build strong cell walls for sturdier plants, and increases plant vitality.

GrowGreen's SRP contains also contains high levels of silica which helps to maintain phosphorous in plant available form; reduces the lockup of phosphorous by aluminium, iron and calcium and reduces potassium leaching. There is also growing evidence that silica is especially beneficial to plants growing under stressful conditions (Luyckx, et al., 2017). Silica is known to alleviate the toxic effects caused by abiotic stresses, e.g., salt stress, drought, heavy metals etc. and ameliorates the vigour of plants and improves their resistance to exogenous stresses.

What controls the availability of phosphate?

[1] From: https://www.convertunits.com/molarmass/Phosphorus+Pentoxide

Not all phosphate is immediately available. A number of different factors impact on the solubility of rock phosphate and its availability to plants - this includes the chemical properties of the rock phosphate itself; as well as soil and management factors.

The solubility of rock phosphate increases with decreasing particle size. The finer the particle size, the greater the degree of contact between rock phosphate and soil, and therefore, greater the rate of dissolution. Phosphate solubility is not related to the total P_2O_5 content but to the CO_3:PO_4 ratio of apatite. It has been well established that increasing substitution of CO_3^{2-} for PO_4^{3-} in the lattice structure increases the solubility of carbonate apatites (Kumari & Phogat, 2008).

Phosphate availability is also a function of acid soil conditions and/or active soil biology, i.e. soft rock phosphate becomes available rapidly in acidic soils. In alkaline soils, it should be combined with compost, humates, compost tea or microbial products such as GrowGreen's Digesters. Examples of common PSM (Phosphate Solubilizing Micro-organisms) include bacteria such as Pseudomonas, Bacillus, Rhizobium, and Enterobacter. While among the fungal group Aspergilli and Penicillum are well known.

How is GrowGreen's SRP best used?

Rock phosphates are applied as a fine powder that is thoroughly mixed through the soil prior to planting. Broadcast and incorporate it into the soil. This enhances the continued dissolution of the rock phosphate. Plant roots are more likely to intercept the phosphorus dissolved from rock phosphate particles that are dispersed widely through the soil so increasing the proportion of the dissolved water soluble phosphorus taken up by plants than is adsorbed by soil. A rate of 250kg/ha is recommended but a soil test showing the current levels of P and Ca are recommended in order to obtain an accurate treatment.

The time required for the dissolution of phosphate rock necessitates it is applied in advance of plant demand. Phosphate rock reaches maximum solubility 4 to 8 weeks after application. However, depending on soil conditions phosphate rock applications can last up to 5 years.

Microorganisms directly affect the ability of plants to acquire phosphate from soil through a number of structural or process-mediated mechanisms. GrowGreens's SRP is microbe-friendly which is imperative for a healthy soil regeneration program producing the ideal nutrient-dense products. There are real benefits to using rock phosphate alongside other products to encourage beneficial soil micro-organisms.

Rock phosphate requires acid soil conditions to effectively nourish crops. Low calcium and high organic matter in the soil tend to speed rock phosphate dissolution. Use GrowGreen's SRP to build phosphate fertility where levels are low and/or to increase rooting activity in transplants and sprouting seeds.

GrowGreen's SRP is best used on long term or perennial crops due to the time taken for dissolution in the soil. Suitable crops include tree crops, pastures, vineyards and horticultural crops it has also been found to be effective for canola. Legumes acidify the soil around their roots which assists them in the absorption of P even if soil pH is at the higher end of the recommended level.

Summary

GrowGreen's SRP is a clean sustainable source of phosphate which can be used in all crop production systems. Mined and produced in Australia it is high in phosphorous, soluble phosphorous and calcium and low in heavy metal contaminants. It is easy to use alongside other GrowGreen microbial products which encourage beneficial soil microbes which can help to release phosphate locked up in the soil, and maximise the benefits of SRP.

References

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