ProAqueous
Agricultural
Solutions

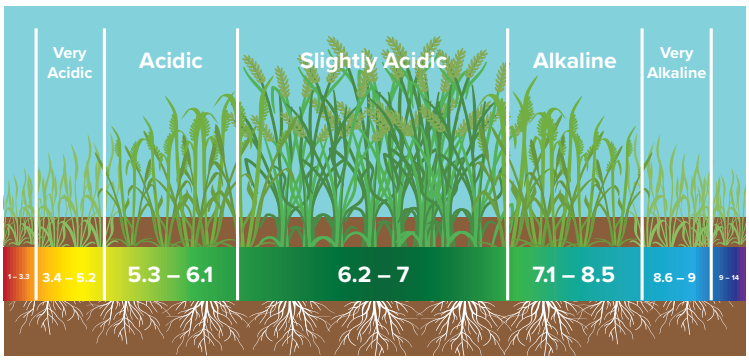
pH Shift

What is ProAqueous pH Shift?

pH Shift is a new product that offers growers a novel way of controlling soil pH.

Soils can become acidic through the application of fertilisers, nutrient uptake by crops or soil chemistry. Acidic soils can reduce the availability of nutrients or impede root development to negatively impact crop growth, alongside promoting the development of certain diseases such as club root in Brassica. Conventional control of pH is achieved through the application of limestone which can be expensive to implement and difficult to achieve in small-scale field settings. Conventional liming is also slow acting and long lasting, meaning that it can be difficult to achieve optimum pH levels for different crops grown in rotation.

Proper pH levels for growing wheat.



pH Shift is an emulsion of micronized lime achieved through the use of patented surfactant technology which can be applied directly to the soil as a liquid. This facilitates fast-acting, precise control of soil pH to help growers achieve optimum conditions for their crops at the root zone. This is of particular relevance as growers increasingly adopt GPS-mapping technology to aid them in precision control of fertiliser/soil pH control. **pH Shift** will also be of interest as a soil drench when planting brassica transplants grown in compost to provide early-season pH control before the crop establishes to aid club root control.

Proaqueous pH Shift in Detail

pH Shift is a new product for the UK commercial horticulture market, based on micronized calcite.

While the benefits of pH adjustment in field production of vegetables are well established, the majority of growers currently rely on conventional bulk application of granulated limestone to achieve pH adjustment, although these can vary based on lime source and offer additional minerals to the soil such as magnesium (e.g. dolomitic limestone). The UK horticulture market is typified by the requirement for the production of produce to a high specification that can achieve a premium at market, so rough, imprecise control of pH achieved through conventional liming can be insufficient, limiting optimum nutrient availability and uptake in the crop.

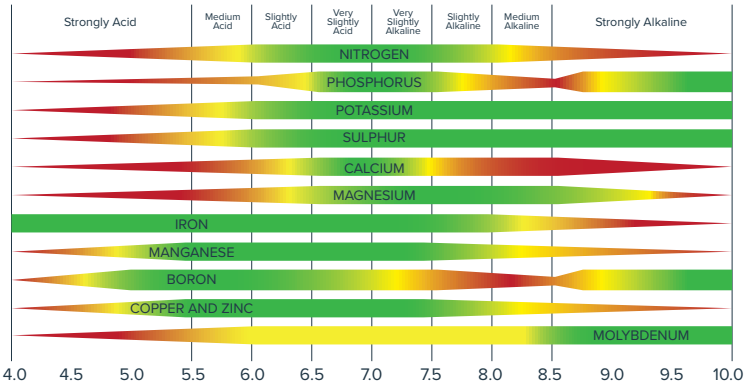
pH Shift offers a new way for growers to have rapid, targeted, control of soil pH to ensure that field conditions are optimised for horticulture crop production.

Managing Soil pH

Soil pH can be subject to a wide range influences, this can in turn influence the quality and yield of a crop through a variety of routes.

Agricultural soils in the UK typically have a pH of between 5 (mineral soils) to 7.5 (limestone soils), although levels approaching pH 4 can be seen in peat-based soils. Besides field-scale soil, a wide range of growing media products are used for horticulture production either as an inert media (e.g. coir for tomato or strawberry production), as part of the finished product (ornamentals) or as propagation media and while these are formulated to have a pH range suited for purpose (pH 5.5 – 6 if peat based, or higher if wood chip or green waste-based) this may still require adjustment, especially where compost-grown transplants are planted in the field during propagation (e.g. brassicas). While soil pH can be balanced before planting, acidification may take place due to the application of acidic fertilisers (e.g. sulphur, urea or ammonium), breakdown of organic matter or nutrient uptake by the crops.

How soil pH affects availability of plant nutrients.



Soil pH can have a significant impact on the availability of nutrients for the growing crop. Lower pH soils promote the dissolution of Al3+ ions which will negatively impact plant growth

through inhibition of root growth, impacting soil penetration and root architecture. Aluminium toxicity will reduce a plant's ability to absorb sufficient nutrients from the soil, risking deficiencies of nitrogen, potassium, phosphorus and manganese. Other essential micronutrients (molybdenum, iron and copper) are less soluble in acidic soils, reducing their availability to the crop. As a result of these influences, crops grown outside of their preferred pH range are at increased risk of developing deficiency symptoms or being prone to stress which can ultimately impact yield outputs. This can also decrease the efficiency of nutrient applications, requiring growers to utilise more expensive methods of applying the nutrients to their crops (e.g. foliar applications) to achieve desired yield outputs.

Besides nutrient availability, soil pH can have a range of crop-specific impacts. For instance, brassica crops (particularly cauliflower and calabrese) are susceptible to root infection by Plasmodiophora brassicae which causes distortion of the roots and gall formation leading to under development of heads or crop failure (Figure 1). Club root development is considerably more prolific in acidic soils, so growers will aim for a pH >7 to aid management of the disease. Club root is an emerging problem, and outbreaks are being seen on farms with no prior history as a result of shorter rotations, milder/wetter winters and increased transmission between fields increasing the risk of brassica crops developing the disease.

Conventional pH balancing requires the application of agricultural lime to the soil as part of a multi-year program to target required pH levels. Limestone from a variety of sources is ground to a required scale and is supplied to growers for bulk application to their fields,

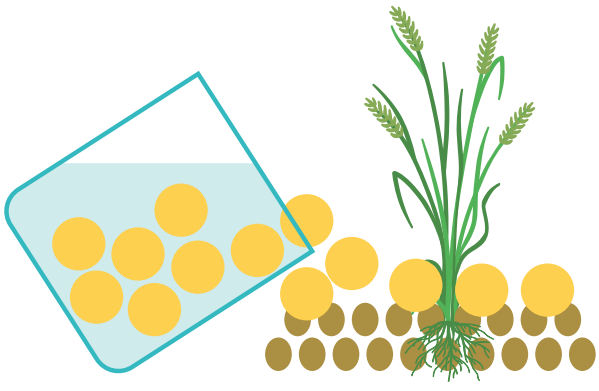
typically directly from a quarry business, although this can create problems for growers. As field liming requires specialist equipment and may only be carried out ever 3 – 5 years, it is frequently contracted out to a specialist company at additional cost. Furthermore these companies may have restrictions on minimum areas of land that can be treated, creating complications for growers of smaller areas of land or with large multi-crop rotations. Lime application can also be impacted by soil condition and weather, creating narrow windows where it can be applied. In order for lime to be effective, it must be in contact with the soil and so deep tillage is required, although this can be in conflict with minimal tillage systems. This is also unsuitable for deep-rooted perennial crops such as rhubarb and asparagus that overwinter as large crowns which remain buried for several years. Conventional agricultural lime has a particle size of 0.3 – 0.9 mm, although larger particle size will reduce the speed at which neutralisation takes effect.

Some micronized products of finely ground lime with typical particle size below 150 microns are available but these are still applied as a solid (typically as a granule or prill) to the soil. This can result in higher levels of application to the soil, as well as prolonging the period of effect. This can cause a problem in land used for crop rotations including brassicas and potatoes. The effects of lime application to control club root in Brassica can persist into subsequent crops of potato, where the incidence of potato scab (scabs or lesions on the surface of tubers caused by Streptomyces scabies infection) can significantly increase in severity with greater soil pH.

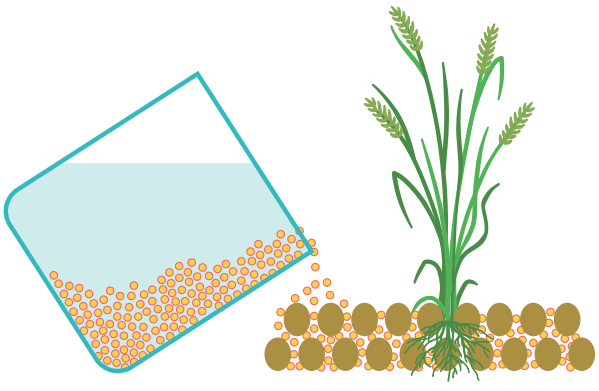
How does pH Shift differ from conventional pH management systems?

pH Shift offers growers a new way of optimising pH in soil through rapid, precise, application of lime.

As previously established, the size of lime particles applied to the filed directly relates to the speed at which the lime product can impact soil pH, with finer particles showing greater reactivity. The insoluble nature of lime means that no matter the size of the particle it can only be applied as a solid as it will sediment out of any liquid solution. **pH Shift** represents a step change in lime application – the use of a the patented surfactant means that micronized lime can be held in a stable, permanent suspension as an emulsion with the particles prevented from forming aggregates and dropping out of solution, ensuring a much more evenly dispersed solution. This means that micronized lime can be applied to the soil to achieve the greatest level of reactivity compared with conventional lime products. As a liquid it can be applied through precision spraying for near-immediate effect, even when compared with micronized lime prills that will still require slow dissolution once spread into the soil.



Typical Lime: 250 µm



M3T Lime: 0.6 µm

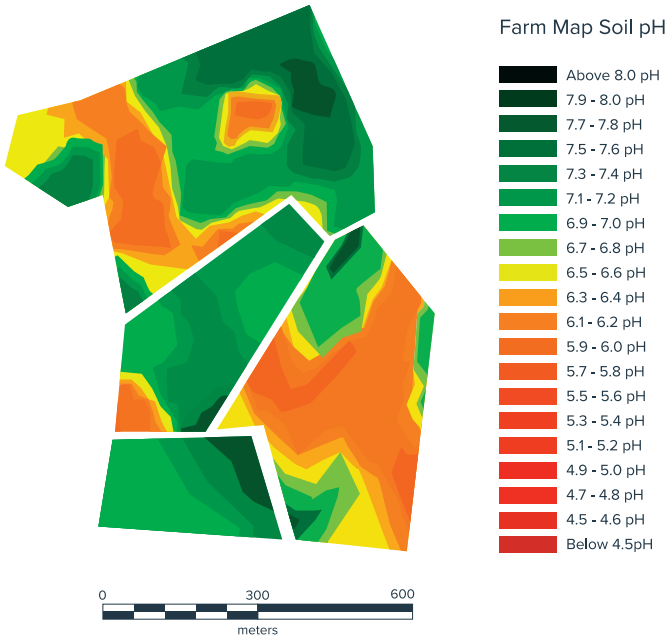
What are the Benefits of using ProAqueous pH Shift?

The liquid nature of **pH Shift** immediately sets it apart from other micronized lime products which are granular based.

It's uniquely suitable for application in areas of land that are difficult to access with standard equipment, and can be applied as or when required (independently of weather conditions) and using existing equipment without requiring external contractors.

The liquid nature of **pH Shift** may also allow greater penetration into the soil, allowing pH adjustment to be carried out throughout the entire root zone (unlike granular micronized products which only impact the top few cm of the soil). The fast acting, short-term action will also be relevant to growers using multi-crop rotations.

Lastly, as growers continue to adopt precision nutrient application approaches based on GPS/ mapping technology, the liquid nature of **pH Shift** will directly contribute to spot treatments and precision-controlled application of lime. This may come at a greater cost than conventional lime, but is likely to be far more rapidly acting than a base dressing of plugs, achieving effective control from the point of planting. Conventional soil pH assessments are based on composite samples that give an average pH across a field, but there is increasing shift towards the production of a contoured pH “heat map” based on regular sampling across the field using a GPS-based grid system. If this information is combined with precision application of **pH Shift** it will be possible to greatly promote a uniformity of pH across a field, improving crop uniformity and improving overall quality.



In cases of pH-linked disease development this will also help to preclude disease-rich areas of the field that could provide a site of infection for the wider crop. Standardising pH across the field will also allow growers to achieve greater uniformity of nutrient uptake and use.

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For more information please visit **www.proaqueous.com**

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