

Applying Ca, Mg and lime to orchids

The following article discusses the various liming agents and their suitability for application to orchids. Liming agents can be applied to change the pH of the growing medium or to supply additional calcium (Ca) or magnesium (Mg). It also describes products for supplying additional calcium and magnesium that do not affect the pH.

Optimum pH for orchids

The pH is a measure of the acidity of the growing medium or water. The pH is important as it can directly affect the orchid root growth and influence the availability of essential nutrients to the plant. Some elements become less available as the pH becomes high (alkaline) but alternatively can become toxic if the pH becomes too low (acid). The pH can also affect the growth of bacteria and fungi that may be important for the growth of the orchid. If the pH is too low (too acid) some elements can become too available and be toxic to plant roots.

The optimum pH and lime requirements of orchids is subject to much debate but varies with the species. The optimum pH for a particular orchid species will be influenced by the environment in which it evolved. Orchids, and particularly epiphytes, often grow in heavily leached decomposing organic matter which is a slightly acidic medium. High rainfall leaching environments where orchids grow could also be expected to be more acidic (4).

Even orchids found on limestone rocks, which suggests an alkaline environment, may grow in a crevice filled with organic matter that may be slightly acid (16).

The optimum pH for an orchid species as recommended by different growers will vary depending on the components of the potting mixes they use, the fertilizers they apply, their water quality and watering frequency.

As a general rule of thumb, the optimum pH for orchids is considered to be around 6.5 which is typically the pH of rainwater which is slightly acidic ranging from pH 5.7 to 6.8 (4). A pH between **5.5 and 6.5** should be adequate for most orchids as this is the pH range where most nutrients are freely available without being either toxic or deficient (17). There are exceptions, however, with some orchids growing best at a pH as low as 4.5. These are discussed in more detail below.

Orchid mixes that utilize pine bark will tend to be more acid and most mixes will become more acid with time as they decompose and are leached (17). This may not be a problem if plants are repotted every year or so and fresh potting mix is used and thus restoring the pH to a more neutral value. If plants are not repotted frequently some adjustment of the growing medium pH with lime or dolomite may be necessary.

Very little information is available in the literature on the optimal pH for different orchid species. Furthermore, very often the methods used in pH measurements were not reported. As the pH values obtained by different measurement methods can vary by >1 pH unit, it can make comparisons between different reports difficult to interpret. All the pH values referred to in this paper were measured in water not CaCl₂ which is another common method.

The Cymbidium Orchid Society of Victoria suggests that *Cymbidium* orchids have an optimum pH around 5.5 (11). The optimum pH is lower for Australian native

cymbidiums and Harry McElroy states that *Cymbidium suave* grows in tree stumps where the pH is relatively acid between pH 4 and 5. Application of liming products to these orchids is therefore not recommended (5), but adding acidifying agents to lower the pH, such as pineapple juice or coffee grounds, may be beneficial (5).

In contrast, other orchids are found on calcareous rocks and so might be expected to prefer more neutral and less acid growing conditions. Many slipper orchids (*Paphiopedilums*) for example are found growing on limestone mountains which suggest they might require a high calcium and a more neutral pH growing medium from pH 6.5 to 7 (4, 12, 16). An understanding of the origin of the species is therefore important. *Paphiopedilums* belonging to the subgenus *brachypetalum* and some in the subgenus *parvisepalum* are said to need additional dolomite lime (13) whereas *Paphiopedilum anitum*, *Paphiopedilum ciliolare* (from Philippines), *Paphiopedilum sangii* (from Indonesia) and *Paphiopedilum papuanum* (from Papua New Guinea) prefer a lower more acid pH (13).

Orchid growing mix from "Orchiata" has had dolomite added during production (13). Therefore species requiring a neutral pH would not need additional lime added. However for species preferring a more acid mix, Orchiata recommend washing Orchiata potting mix before use to remove the dolomite (13).

Les Nesbitt uses a more acid growing medium of pH 5.5 for **Australian native terrestrial orchids** (10). Most eastern Australian soils where terrestrials grow are moderately acid which is consistent with this recommendation.

Dendrobium nobile are also said to prefer an acidic mix with a pH around 5.0 (14). Cedarvale Orchids in Queensland have found **Australian native dendrobiums** do well with a more neutral pH of 6.5 to 7.0 and spray their plants with a lime-water solution in autumn and spring (15).

In summary, orchids are likely to vary in their optimum pH requirement depending on the orchid species and the environment where they originated. The pH of your particular growing medium will vary depending on its constituents and its age, your fertilizer regime, your watering methods and the quality of your water. For this reason there is likely to be some variation in the reported optimum pH values for a particular species.

Testing the pH of the water leachate out of the bottom of the pot with pH test strips will give an indication of the pH of the growing medium, so start by testing the leachate. The product you choose to apply will depend on whether you are trying to supply Ca, Mg, adjusting the pH or a combination of these. You can purchase pH testing strips on the internet.

Care needs to be taken when adding liming products and only apply it to some test plants to begin with. Strongly neutralizing products such as burnt lime and hydrated lime or brickies lime should be avoided.

Liming products

Agricultural lime

Agricultural lime is crushed limestone CaCO_3 . It contains about 37-40% Ca and supplies calcium for plant growth and decreases soil acidity, i.e. raises the pH. It can be crushed

to different fineness or particle size. Super fine agricultural lime or Aglime reacts reasonably **quickly**, typically over several weeks to a month if the soil is moist. If it's less finely ground it is slower to react and dissolves more slowly. Aglime is typically used in the garden to raise the pH and add calcium.

If larger **limestone chips** are used in the orchid growing mix they will dissolve **very slowly** and only supply a very small amount of Ca and have a minimal effect on raising pH.

Down Under Native Orchids recommend the application of **lime-water** (F70 Superfine Aglime lime dissolved in water at 1g per litre) in early autumn and early spring (3). They suggest this is beneficial when growing plants in pine bark which is an acidifying material.

Dolomite

Dolomite is natural occurring rock containing calcium carbonate (lime) and magnesium carbonate. Dolomite is $\text{CaMg}(\text{CO}_3)_2$ and supplies both Ca and Mg. It typically contains 22% calcium and 12% magnesium. Dolomite will also cause a soil to become less acid i.e. raise the pH. It is **slowly reactive** and will change the pH over weeks or months. Dolomite is often blended with additional lime to produce **dolomite lime** which has a 5:1 ratio of lime and dolomite. This ratio better matches the plant requirements of calcium and magnesium.

Burnt lime or Quick lime.

Burnt lime is calcium oxide (CaO). It results from heating limestone to drive off carbon dioxide. It is more concentrated than agricultural lime, is caustic and difficult to handle. It is rarely used in horticulture.

Hydrated lime, Brickies lime or Slaked lime

This is calcium hydroxide ($\text{Ca}(\text{OH})_2$). Often referred to as brickies lime. It is **highly reactive** and can burn plants. It is **not** used on gardens. It has a much stronger neutralising affect than Aglime and can cause soils to become too alkaline. It is used in concrete and mortar.

Crushed shells

Mainly composed of calcium carbonate (CaCO_3). It is usually too coarse to be effective in the soil as source of calcium or influence the pH. Any effects will be very slow.

Other sources of calcium and magnesium

Gypsum

Gypsum is calcium sulphate CaSO_4 . It supplies both calcium and sulphur.

Cattleyas and to a lesser extent **Paphiopedilums** are said to be prone to calcium deficiency which appears as black rot on leaf tips during rapid growth in the warmer growing season in newer leaves (8, 9). The first signs of calcium deficiency in cattleyas is a watery lesion that



turns black (9).

Gypsum is fairly soluble and has a minimal to **no effect on soil pH** but is a good source of calcium and sulphur. It is used on some types of clay soils (sodic clay soils) to improve soil structure and cause them to be more friable rather than setting hard.

Epsom's salts

Epsom salt is magnesium sulphate ($MgSO_4$). This product supplies both magnesium and sulphur but has a minimal effect on soil pH. Magnesium is important for flower production and is said to be beneficial for *Phalaenopsis* and *Cymbidiums*. Magnesium deficiency occurs in older leaves (8) and appears as a mottling of the leaf cupped leaves and yellowing between the leaf veins (chlorosis).



Magnesium deficiency

It frequently appears during cold weather and for this reason application of Epsom salts is said to protect against cold. In fact it is just ensuring a good supply of Mg when its uptake is reduced.

Applying Epsom salts also assists in flushing salts from the potting medium that have built up through fertilizer application or using water with a high salt content (6). Application of 1 tablespoon per 4 litres twice per year is suggested in the literature (7).

The best product to apply will depend on the actual problem to be addressed. For addressing acidity problems, fine agricultural lime or dolomite lime is the best choice. If it is to address Ca and/or Mg deficiencies, then gypsum or Epsom's salt is the preferred choice. However most orchid fertilizers will contain sufficient Ca, Mg and S and application of either gypsum or Epsom salts should not be required as a nutrient source.



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