Fertilizer and pH

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pH and Nutrition

•What is pH?

- •Put simply it is the reciprocal log concentration of Hydrogen-ions per litre.
- •Put even simpler it is measured on a scale from 1 – 14
- •1 being most acidic and 7 being neutral.
- •Each number decrease from 7 = 10x concentration of hydrogen ions.
- •The preferred pH for orchids
- •Between 5.8 and 6.5

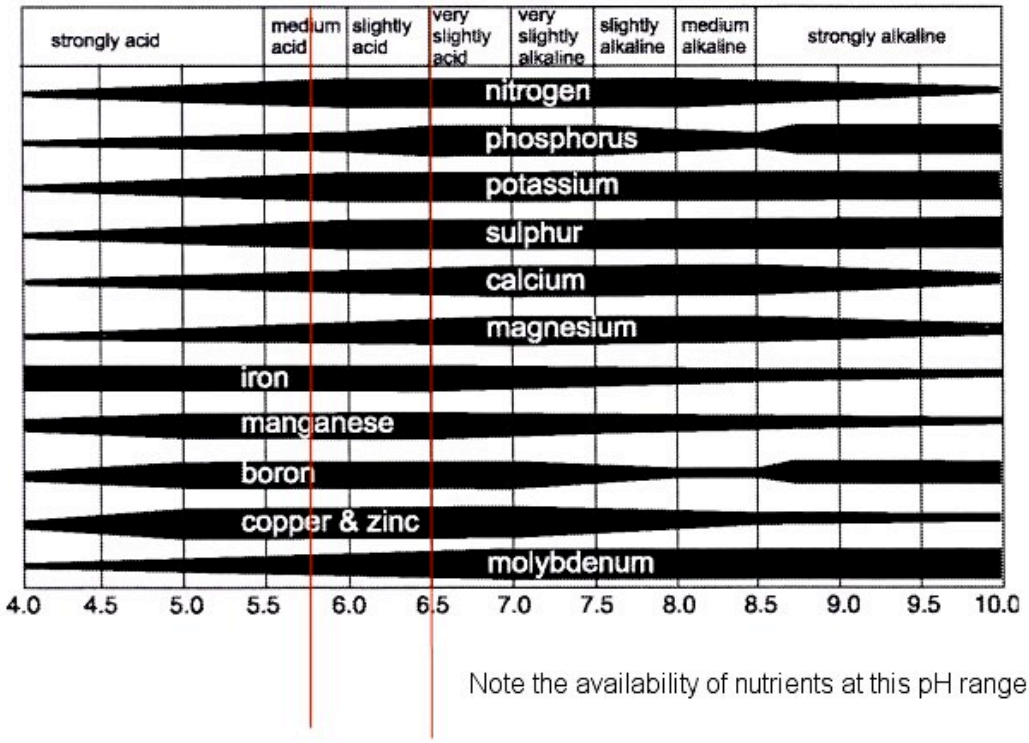
What effects pH for plants?

- •Type of material used for potting mix.
- •Addition of OH^- ions or acids, eg. Phosphoric Acid
- •The breakdown of organic matter in the potting mix creates organic acids– this lowers the pH.
- •The use of fertilizers in general & nitrogen supplied as ammonium or urea also reduces the pH.
- •How does pH affect orchid nutrition?
- •For orchids to grow properly they require the growing medium along with water/nutrients to have a pH within the specific range.
- •Lower pH below 5.8 = Changes:
  - –Decreases nutrient availability – insoluble
  - –Increases Al^{3+} ion toxicity
  - –Microbial activity decreases
  - –Influence on fertilizer efficiency. * Reduced Availability = increase cost for same results.
  - –Influence on plant growth – uptake effected.
- •As the soil pH increases from a more acidic condition to pH 6.5
  - –Macronutrients (N, P, K) increases in solubility.
  - –Secondary nutrients (Ca, Mg, S) also increases in solubility.
- •Micronutrients (except Molybdenum) decreases in solubility.

•Aluminium ions decrease resulting in reduced effect on plant roots (very important) and uptake and movement of nutrients.

•Al^{3+} ions increases at and below pH below 5.5

Chart of the Effect of Soil pH on Nutrient Availability



pH Correction

•Addition of Limestone eg. Calcium Carbonate (garden lime) – slow acting

•Use Dolomite when magnesium is also required or desired.

•Hydrated lime – quick acting 82% Ca. Can be added to liquid nutrient in dilution.

•Gypsum ***is not*** suitable for pH correction.

•Testing water runoff with pH strips or pH meter

Fertilizers

Fertilizer Requirement and Rate of Use

- The type, brand, rate & frequency a fertilizer used generally choice of user.
- Can be influenced by the type of growing mix used and the amount of water given.
- Available time.
- Can be scientifically based & for the nutrient requirements of a particular genus.
- But is generally hit and miss.
- How do we decide?
- Use by rate recommended by supplier??
- Why?
- Cymbidiums, Cattleys and Phalaenopsis etc. all have different requirements for most macro-nutrients.

Scientific Study of Requirements

- A study conducted by Hugh A Poole & John G Seeley from the **Department of Floriculture and Ornamental Horticulture Cornell University Ithaca NY** into nutritional requirements of the three orchid genera mentioned.
- N, K & Mg levels were studied.
- Conclusions reached was cymbidiums require different amounts of macro nutrients to the other genera studied.
- Application on a regular basis achieved optimum growth.

Required Nutrient Levels

- The level of N, P, K, Mg & Fe that gave the best result for Cymbidiums was.
- 100 ppm – N
- 20 ppm – P
- 75 ppm – K
- 25 ppm – Mg
- 8-10 ppm – Fe.
- The only difference we experience as growers is:
- The study didn't allow for nitrogen draw down

- Draw down is due to the activity of micro organisms breaking down organic matter & as mentioned it changes the pH as a result.
- Used an inert medium
- Plants were grown in glass beads.
- Additionally Calcium is a required macro nutrient, up to 100 – 200ppm can be used.

To calculate Parts per Million (PPM)

- Simple process, if the fertilizer, eg. Phostrogen, has the N : P : K ratio shown as the percentage (%)

  14 : 4.4 : 22.4

Calculating Parts Per Million

If 1 gram of the fertilizer is dissolved in 1 litre of water approximately 1/5 level teaspoon. Simply add a ZERO to the % = PPM

- The PPM is 140 : 44 : 224
- Recommended 1 level teaspoon 9 litres = 77.8 : 24.4 : 124.4 PPM – watch this space???

Types of Fertilizers Used

- The fertilizers most commonly used by growers:
- Organic / Enhanced Organic
- Slow Release Inorganic
- Soluble or Liquid Inorganic

Organic Fertilizer

- Most low in nutrients eg. Dynamic Lifter N:P:K = 3.0 : 2.4 : 1.5
- Little control and slowly available in solid form – better to use liquid form BUT????
- Based on the study, how much would you use over the major growth period?
- Significant effect on lowering the pH.
- Requires constant pH adjustment.
- Benefits. No salt build-up in the mix.
- Solid form can't wash it away in one watering.

- Steadily available in rainy periods.

•Kelp/Seaweed extracts are essentially - **not fertilizers.**

•They do however contain beneficial growth substances, trace minerals, plant protein and enzymes etc.

•Other substances that can be used include Zeolite, Humic and Fulvic Acids. These can have beneficial effects on plant growth.

Organic Summary

•Organic fertilizers make some grower feel cozy about fertilizing, trial and error - results based?

•Better as an addition to regular inorganic fertilization of pot plants.

•Dynamic Lifter – What's the point?

•Value of some so called enhanced organic?? brands is based purely on marketer skill and anecdotal hype.

•Some cymbidiums are grown successfully in just HORSE manure and that's no Bull S**t!!

Controlled Release Fertilizer

•Depends on quantity used, quality of release mechanism, temperature and water.

•Nutrients amount is not **consistently** provided to plants eg. If watering on hot days more fertilizer is released than on colder day.

•Much more suited to large scale production without expensive irrigation/fertigation system, but what do you buy????!!!!

Controlled Release Summary

•Good to use if time constraint prohibit using soluble fertilizer.

•Buy the best on the market at the correct N:P:K and check source of Nitrogen.

•Ensure N:P:K ratio is adequate and what of Mg, Fe and Ca requirements. Dolomite?

•Timing of application and reapplication is important because of released quantity of recent application – deteriorates over time.

•Timing of water and amount of water given.

•Contradicts flushing salts out of mix between fertilizer applications, if used too heavily.

Soluble or Liquid Fertilizer

•With liquid nutrients, the grower can provide exacting nutrient quantity at regular intervals.

•Balanced fertilizer program.

•Easily varied to suit changes required.

•Requires more time to apply than slow release or solid organic fertilizer. Every week or so.

•If using a home mixture, then correct Nitrate to Ammonium ratio can be achieved.

•Same amount of fertilizer applied each time.

•Only difference is watering provided between fertilization.

Dilution of Fertilizer

•Phostrogen N : P: K = 14 : 4.4 : 22.4 if used at 1 gram per litre of water provides N:P:K ratio of 140 : 44 : 224 parts per million. By increasing the dilution to 1 gram to 2 litres of water changes the rate to 70 : 22 : 122 ppm.

•Mixing of different brands of fertilizer or adding to dilutions is required to achieve desirable N : P : K ratio.

•My fertilizer:

N = 79.95ppm, P = 20.07 ppm, K = 75.13 ppm. Use 92.31 grams in 240 litres.

Addition of 60 gms of Ca NO^3 to 240 litres of water increases N = 118.7 and Ca to 47ppm.

•Cost before increase $1.68 Kg + CaNo3 @ 12¢ for 60 gms

•Added extra Ca as CaOH to adjust pH or as Ca EDTA and some higher K as KOH.

Soluble Summary

•Orchid nutrition is not necessarily hit and miss.

•Used at incorrect dilution results in wasted fertilizer and wasted money.

•Dramatic increase in fertilizer cost in recent year eg. MAP 2008 costs $132.00 up from $49.50 in 2005.

Some important facts for all inorganic fertilizers.

•Fertilizers alter the pH of the potting mix, more so if using easily decomposed organic potting materials.

•Urea in a fertilizer requires the soil enzyme urease from microorganisms to break down urea into ammonium and CO^2 at suitable pH.

•The greater the change in pH - depends on quantity of urea in fertilizer.

•Conversion of urea varies with temperature eg. at 26^{o}C 90% in 2 days & at 2^{o}C 10 days is needed.

•Urea doesn't register on a conductivity meter (if you use one), so recalculating **TOTAL** Parts per Million (PPM) is required to account for % of Urea in the fertilizer.

•Conductivity meter only measures conductivity, Total Dissolved Solids or total PPM not the N : P : K ratio.

•For best results there should be a Nitrate to Ammonium ratio in the fertilizer of 4 : 1 and NPK should be calculated.

•Some fertilizer eg. Aquasol uses large amount of urea and potassium chloride as sources of nitrogen and potassium.

•Potassium chloride contains chlorine ions. This causes salt build-up and root damage or loss if the mix dries too much. Particularly in combination with Aluminium Ions at low pH.

•A fertilizer's concentration & N:P:K is doubled as the mix dries by 50% until further water is applied.

•This makes use of high fertilizer concentrations ?????

•The same fertilizer as shown can be varied simply by changing it's dilution rate. So when someone says they use Campbell's Yellow

•Increasing K levels results in lower concentrations of magnesium and calcium

•Very high K concentrations results in shorter flower spikes.

•100 ppm Nitrogen reduced growth in Cattleyas.

•The use of Eco-Carb 33% K

•Provides 330 ppm of potassium if used at 1 gram per litre. Normal use is 4 grams per litre = 1320 ppm if sprayed too heavily, adds to the K supplied to the potting mix.

•Also used to increase pH of soil.

•There is Calcium in Sydney's water supply. How much? Check with Sydney water and calculate total.

THE END

THANK YOU