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A Comprehensive Guide to orchid Culture

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1 Introduction to orchids

1.1 Orchids in the plant family

In the plant family flowering plants form a group called Angiosperms. In this group there are lineages:

- Amborellaceae: includes just one shrub that, according to the National Geographic (July 2002) "may be the closest living relative to the first flowering plant".
- Nymphaeaceae which includes the water lilies.
- Illiciaceae which includes the star anises.
- Magnoliids, which of course includes Magnolias, avocado and black pepper,
- Monocots which with 65,000 species (1/4 of all flowering plants), are recognizable because they have just one seed leaf (single cotyledon). This group includes all grasses (corn, rice, wheat,...), palm trees (which are giant herbs) and flowers such as lilies and orchids. Orchids by themselves account for nearly 25,000 species.
- And, finally, Eudicots (formerly dicots because of their two seed leaves), the largest group of angiosperms with 170,000 species, many of which are woody plants.

Most of this information is from the above mentioned National Geographic issue.

1.2 What is an orchid?

What distinguishes orchids from other flowering plants is the combination of three elements:

- their pollen (called "pollinarium", plural = pollina) which is formed into a mass (usually 2 masses),
- stamens and pistils are joined together in a structure called a "column",
- their seeds are very small (there may be up to 3 million in a seed capsule), they do not contain endosperm and have no organized embryo.

1.3 Structure of orchid flowers

Orchid flowers consist of:

- the pedicel (the stem of the flower which includes the ovary),
- the sepals,
- the petals,
- the column.

Sepals and petals are in threes.

The three sepals consist of the dorsal sepal and two lateral sepals.

The three petals consist of two petals and a modified one called the labellum, or more commonly, the lip.

1.4 How orchids grow in nature

Besides these morphological differences most orchids differ from other plants by the way they grow in nature.

Most orchids are ***epiphytes***, that is they grow attached on other plants (usually trees). ***They are not parasites***, that is they do not take anything away from the plant they grow on, they merely use the other plant (tree) for support.

Some orchids are lithophytes, that is they grow on rocks.

Some other some are semiterrestrial, that is they grow on the ground, on decomposing plant material (not quite soil).

And finally, a small number of orchids are true terrestrial, meaning they grow in soil like most plants.

1.5 A bit of orchid history

Confucius, the Chinese philosopher, grew orchids in the fifth century BC and wrote a poem about them.

Theophrastus, a Greek philosopher and scientist, mentions orchids in his "Essay on Plants" published around 300 BC

Dioscorides, a Greek botanist, physician and pharmacologist mentioned orchids in his work "De Materia Medica" ("Of Medical Maters") published around 60 AD This work remained a reference manual till the Middle Age (1,400 - 1,500 AD).

Orchids, in those times, were believed to have medicinal properties, one of them being an aphrodisiac.

And about 2,000 years ago Greeks gave orchids the name "orkhis" which means testicle, because of the form of their pseudobulbs (pseudo = Greek for "false").

In more recent times, the first record of orchids in cultivation dates back to 1731 in England. Philip Miller mentioned several orchids in his second edition of "Dictionary of Gardening" (1768).

Records of the Kew Royal Botanical Gardens show that Epidendrum cochleatum flowered for the first time in cultivation in 1787. Ten years later 15 orchid species were cultivated at Kew.

Cultivation of orchids started in earnest in the 19th century. At that time orchids were brought to Europe by companies or individuals who financed collecting expeditions. They commissioned professional collectors who traveled for months all over the world in search of showy new species. Like treasure hunters these expensive enterprises were often shrouded in secrecy and it was not unusual for them to spread misleading information about the locations where new orchids were found.

New exotic orchids were most often sold at Protheros & Morris & Stevens Sales Rooms in London, fetching extravagant prices.

At that time very little was known about the cultivation of orchids and their survival rate was dismal.

Through experimentation and by gathering more information on the growing conditions of orchids in their natural habitat, knowledge was slowly being developed and by 1851 B. S. Williams published the first edition of "The Orchid Grower's Manual".

By the end of the 19th century there was enough experience and knowledge about the growing conditions of orchids that many orchids survived and bloomed in England's greenhouses.

Today there is a wealth of knowledge about growing orchids and modern propagation methods have driven prices to affordable levels. Affordable prices, the fascination exercised by their captivating beauty and their diversity has made them increasingly popular houseplants.

1.6 Taxonomy / nomenclature

The International Code of Botanical Nomenclature (I.C.B.N.) and the International Code of Nomenclature of Cultivated Plants (I.C.N.C.P.) govern the naming of orchids.

The I.C.B.N. has standardized classification of plants and imposed the following endings:

• family	: aceae.	Example: Orchidaceae
• tribe	: eae.	Example: Vandeae.
• subtribe	: inae.	Example: Sarcanthinae.

Below the subtribe are the genera (singular = genus). Examples: Cattleya, Dendrobium, Phalaenopsis, ...

Note: all of the above have their first letter ***capitalized***.

Within the genera are the ***names identifying individual plants***. Example: Phalaenopsis **a**mabilis or Phalaenopsis **E**ver **S**pring.

Names of species ***are not capitalized***: Phalaenopsis amabilis designates a species,

i.e. a naturally occurring plant. Names of hybrids (man made crosses) ***are always capitalized*** as in Phalaenopsis Ever Spring.

Finally, within a group of individual plants they may be variations which, for example, may be noted Phalaenopsis amabilis var. formosana.

Variety is often abbreviated as "var." and is usually reserved for species. For hybrids, varieties will be identified by adding to the name one or several words placed in single quotes as in Phalaenopsis Ever Spring 'Light'.

All new plants (species and hybrids) are registered with the Royal Horticultural Society of London.

The name of orchids is decided by the discover for new species or by the first person who registers a new hybrid.

Until a new hybrid is registered it will be identified by the name of it's parents, separated by an X. For example: Phalaenopsis amabilis x Phalaenopsis violacea or Phalaenopsis (amabilis x violacea) or Phalaenopsis amabilis x violacea or, in abbreviated form, Phal. amabilis x violacea.

1.7 Propagation of orchids

There are several ways to propagate orchids.

Propagation from seed or sexual propagation

Pollen is used to pollinate a flower. When the seed pod matures (which may take several months), the tiny seeds can be sowed.

Not all seed pods will contain seeds as one or the other parent may be sterile.

The encapsulated seeds are in a sterile environment as long as the seed pod is closed. It will eventually crack open at a certain time, in which case the tiny seeds will have to be decontaminated before sowing them.

Most people prefer to work with a "green pod". That is a seed pod that has matured but is collected before it starts to open.

The seed pot is externally disinfected to kill any germs, spores, contaminants, ... that may be on it's surface then it is cut open with a disinfected tool (scalpel,...).

Then the seed masses are sown into a flask which contains a nutrient solution (the flask and its contents were previously sterilized in an autoclave). This flask is called a "mother flask".

This whole operation has to be performed in a sterile environment. Commercial growers will use an apparatus called a laminar flow hood (see page 36 of An Introduction to Orchids South Florida Orchid Society

The nutrients solutions contain minerals, sugars, charcoal, sometimes banana extracts or coconut milk, ... Agar (a substance like gelatin) is added to make the solution more or less solid.

The flask is sealed, marked / labeled and placed in a growth chamber / room where light is relatively limited and temperatures are relatively constant.

After several weeks to several months the tiny seeds will germinate. When they have they will have to be transferred to several other flasks in an operation called "replating". This is necessary because the mother flask may contain from several hundred to several thousand seeds which now need room to grow.

The replated flask may still contain a hundred to several hundred plantlets, which is way too many plants for the limited space of the flask.

Again after several months the plantlets will be replated and they may need a third replate (some growers replate 4 times !) until they are in their final flask which may contain from 10 to 40 plantlets.

As for the mother flasks, all the replate flasks contain growing media which is different from the germination media. The new replating flasks with their nutrients where sterilized in an autoclave and the flasks to be replated where externally decontaminated. The replating operations are done in the sterile environment of a laminar flow hood.

Plants resulting from sexual propagation may look like the mother plant or like the father or a combination of both or they may have characteristics of ancestors. In other words they may display very diverse traits.

Among these siblings one or several may be significantly more appealing or different than the others. Whoever possess this plant may recognize its uniqueness by adding a variety name to its name. The variety name is placed in single quotes as in Phal. Ever Spring 'Light' or Phal. Ever Spring 'Cardinal' or whatever the owner fancies to name the variety. Only that plant and it's tissue or stem propagated progeny are entitled to bear the variety name.

Tissue culture

As its name suggest tissue culture is done by using plant tissue, mostly the minuscule center of a new growth. A lot of experiments have been made trying to do tissue culture out of leafs, roots,... but so far the most successful method uses tissue from a new growth.

The tissue is excised (cut), its outer layers are removed till the active center of developing cells, the meristem, is reached. Then this tiny mass of cells (it can be less than 1 millimeter in diameter) is cut into 20 or so parts, immersed into a flask with growing solution without agar, so the solution stays liquid. This media for this solution is usually called "multiplication" formula.

The flasks or tubes are placed on an agitator (an apparatus than either slowly rotates or tilts to the left then to the right. The constant movement of the agitator allows the lumps of cells to develop and increase in mass but prevents them from forming roots or leaves.

Once the lumps have sufficiently increased in size they are further cut into small lumps, placed into flasks or tubes and on the agitator. In this process the original 20 tiny masses may now be 400. At the next subdivision we may have 8,000.

This process continues until the desired number of lumps has been achieved.

Then the developed lumps are replated into flasks as is done for germinated seeds. From there on the process is the same as for seeds.

As in seed propagation all these operations require external disinfecting, and working in sterile conditions.

Plants developed from tissue culture, are called mericlones. They usually are very close in appearance (plant and flowers) to the plant from which the original tissue was taken and they are entitled to be recognized by the same variety name as the plant from which the original tissue was excised. So when you see a plant with a name like Cattleya Irene Finney "Z" it means this plant was propagated through tissue culture, using tissue from Cattleya Irene Finney 'Z'.

Stem propagation.

In this technique a flower stem is used for propagation. If we propagated Phalaenopsis in this manner we would be looking for a flower stem with just the first flower open or with up to half the flowers open.

Flower buds nearer the base of the flower stem open first. Below them there will be a number of undeveloped buds, which we usually refer to as "nodes".

The flower stem is removed from the plant and is externally decontaminated.

The stem is cut about 1 inch above and below the node, then dipped in decontamination solution for 15 to 20 minutes.

Then the protective sheath over the node is removed and about 1/8 of an inch is further removed from both ends of the stem (above and below the node).

The cutting is inserted in the media solution which is in a tube or jar or flask which was previously sterilized through autoclaving.

If the operation is successful we may get up to 4 plantlets per node.

Obviously this technique only produces a few plants from a flower stem of the original plant. We may get 10 to 15 stem propagated plants as opposed to the thousands we may get through tissue culture.

Because of the limited yield and the labor intensive procedure stem propagated plants tend to be much more expensive than plants propagated through seed or tissue culture.

On the other hand, unless some abhorrent mutation occurs, these plants will be exactly like the plant they were propagated from.

These plants too are entitled to be recognized by the same variety name as the original plant from which the original tissue was excised.

As with seed propagation and tissue culture all these operations must be conducted in a sterile environment.

Internode propagation

This technique is similar to the stem propagation but instead of using a flower stem as the start up point we use a growth. It is often used with Dendrobiums.

A growth is removed from the plant and is cut in between nodes. The edges are dipped in a fungicide and then either inserted or laid on sphagnum moss kept moist.

If the operation is successful we may get 1plantlet per node, but usually much less than that as many nodes will not develop a plantlet.

Still the technique does not require any sophisticated equipment, is inexpensive and can be done practically by anyone.

These plants too are entitled to be recognized by the same variety name as the original plant from which the growth was removed.

Divisions & back bulbs

Some orchids grow by developing new growth from the base of the plant. After several years they may have 5, 6, 10 or more growths. We may subdivide such plants to get two or three out of the original one.

Often the older growth or old pseudobulbs of these plants do not do anything but if we remove them and plant them separately they will generate new growth.

Again as for the previous methods where plants were propagated by using tissue, or the fower tem, plants resulting from divisions and backbulbs are also entitled to be recognized by the same variety name as the original plant from which the growth or back bulbs were removed. The resulting plants will be identical to the plant we divided or from which we removed the pseudobulb(s).

Keikis

Some orchids, mostly Dendrobiums, are notorious for producing keikis which is the Hawaiian word for "babies".

Occasionally Phalaenopsis will also produce keikis. Some, usually species, do it because it is programmed into their genes, others do it when they are exposed to high temperatures while they are developing a flower stem.

Keikis will develop leaves first. Eventually they will develop roots. When roots have reached about an inch in length we can remove the keiki from the mother plant and plant it in its own container.

Keikis will be identical to the plant they were removed from and are also entitled to be recognized by the same variety name, if any, as the plant from which they originated.

Top cuts

Finally, some plants, mostly vandaceous orchids, tend to grow very tall. Heights of 4, 5, 6 feet or more are not unusual, making them difficult to handle. These also tend to develop new roots along their stem, in between leaves. These can be divided by

cutting off the top portion of the plant as long as this top portion has at least 2 pairs or roots attached to it.

The remaining (bottom) part of the plant will often respond to this attack by sending out new shoots from its base.

Top cuts are of course the same as the plant they were removed from and are also entitled to be recognized by the same variety name, if any, as the plant from which they originated.

2 Potting Orchids

2.1 Growth pattern of orchids

Orchid have two distinct patterns of growth : monopodial & sympodial.

Monopodial orchids, such as Phalaenopsis and Vandas, have a single growth, typically an elongated stem which may be fairly short (i.e. Phalaenopsis) or reach several feet long like some Vandas, Renantheras or like the liana like Vanilla.

Sympodial orchids, such as Cattleyas, Oncidiums, Cymbidiums, Paphiopedilums, have several, sometimes dozens of successive growths.

In sympodial orchids the life of each growth is determinate (meaning it will last 3, 4 or 7 seven years) but the life of the plants may be, in theory, unlimited. The Manual of Cultivated Orchid Species (by Helmut Bechtel, Phillip Cribb and Edmund Launert, MIT Press) says : “the longevity of orchid plants in cultivation is still something of a mystery, for several plants in the orchid greenhouses at Kew are over 100 years old and are still thriving and flowering regularly”.

2.2 Roots of orchids

The roots of orchids perform two basic functions, and in some orchids, they perform a third one. First they secure the plants where they grow. Roots of epiphytic orchids once attached on the bark of the tree they grow on, or to the clay pot they grow in, are nearly impossible to detach.

The second function is to provide the plant with water and dissolved mineral salts.

Roots of terrestrial orchids are relatively simple. They originate at the base of the stem, they are usually thin, long, fibrous and rarely branched. Sometimes, as in the case of Paphiopedilums, they are densely haired (or tomentose) so that they can absorb moisture from the tinniest particles of growing medium.

Roots of epiphytic orchids tend to be more complex, and for good reason, as water supply can be erratic, and this water supply will often contain very limited amounts of mineral salts.

A distinctive feature of the roots of epiphytic orchids is their silvery to gray color. This is due to the velamen which consists of a single or of several layers of epidermal cells. The velamen covers all the root system except for the short terminal tip of the roots. The role of the velamen is to absorb moisture from the ambient atmosphere, and, may be, to protect from cold or heat.

A third quite remarkable function of the roots of epiphytic orchids is their capacity to photosynthesize. In some species the roots have altogether taken this function from the leaves. Genera such as Campylocentrum and Microcoelia are completely leafless, and in an extreme case, such as the genus Taenuiphylum, roots are flat, green and look very much like leaves.

Roots of epiphytic orchids are ***almost constantly exposed to the air***. And though the ambient humidity may be high and, in some cases, tropical rains may be a daily event, ***these roots are never immersed in water***, certainly

not for any extensive period of time.

Roots of epiphytic or lithophytic orchids need a lot of air to function. Its is extremely important to know this as ***most orchids are killed because of excessive water*** (which chases the air).

2.3 Containers / supports for growing orchids

The most common containers / supports for growing orchids are:

Pots	-plastic pots -clay pots -orchid clay pots
Baskets	-Vanda baskets -wire baskets
Supports	-cork slabs, -tree fern plaques, -pieces of driftwood.

Plastic pots

Most commercial growers use plastic pots because they are inexpensive, they are lighter and they are easier to store; because they hold water for a longer period than other pots / containers, because mineral salts (from water and fertilizer) will not adhere to them, and because roots will not get attached to them.

Plastic pots are excellent containers for growing orchids. Their only draw back, is that some plants, notably Dendrobiums, might get top heavy in them.

Green plastic pots are the ones most commonly used plastic pots. Lately clear plastic pots have become more widely available. Advocates of clear plastic pots claim the light transmission of clear plastic pots enable roots to photosynthesize.

If you are going to use plastic pots, look for pots with a fair number of drainage holes (4 to 8 holes on 3" to 4" pots, 8 to 12 holes on 5" to 6" pots,...). .

Clay pots

The advantage of clay pots is the stability due to their weight and their porosity which allows the potting material to dry faster. Of course, drying faster can also be a disadvantage. A possible disadvantage is that roots tend to attach themselves to the pot.

Clay orchid pots

Have either holes or slits on their sides to allow more air circulation than regular clay pots. As a result, they dry even faster than regular clay pots.

Vanda baskets

Are used mostly for Vandas and vandaceous orchids, but can be used for most orchid genera.

Most Vanda baskets are made of cedar or teak wood. Unfortunately the cedar baskets available today tend to decay in a couple of years. Teak baskets are expensive and because teak trees are being depleted it is not ecologically friendly to buy teak baskets. Fortunately plastic Vanda baskets have made their appearance. The ones I saw (4" and 8") are made of sturdy plastic that should last forever if we recycle them.

Cork slabs

Are used for mounting orchids. Pieces of cork range can be as small as 2" by 3" or as large as 12" by 24".

Some orchids will only thrive when mounted on a piece of cork or on a tree fern slab or a piece of driftwood, but many that grow fine in pots will also thrive on a piece of cork and it makes for a much more natural and interesting look.

Tree fern plaques

Are flat, and come in different sizes (4" by 4", 4" by 6", 8" by 8",...). Like cork, they are also used to mount orchids. Although easier to cut than cork slabs I am not crazy about tree fern slabs because some of them are so dense they barely absorb any water while other appear to fall apart as you handle them.

Driftwood

An alternative for cork that also can make for some very intriguing and interesting "compositions".

2.4 Potting materials

Understanding the properties of potting materials will help us select the potting material that best meets the other criterias.

What potting materials for orchids must do is:

1 - hold the plant in place,

2 - hold enough moisture (water) for the needs of this particular orchid,

3- provide an environment that will enhance the development of roots (aeration).

Most potting materials for orchids ***do not provide any nutrients***. We add the nutrients in the water via the fertilizers we use and that's how they are made available to the plants.

There are many potting material for orchids, such as:

• orchid bark,
• sphagnum moss,
• tree fern,
• osmunda fiber,
• coconut chunks,
• coconut fiber,
• lava rock,
• charcoal,
• pieces of cork,
• peat moss,
• rockwool, ...

There are many other potting materials. A grower I know in Hawaii uses the shells of macadamia nuts (which he gets for free), another grower in British Columbia uses straight perlite. I heard of a French grower who uses straight Styrofoam peanuts and many growers in Thailand use 1/2 shells of immature coconuts,..

Today in the United States the most commonly used potting materials are orchid fir bark and sphagnum moss.

Orchid bark

Orchid bark is an excellent material. It is easy to use, it will not hold excessive water and, under normal use will not need to be refreshed for about 2 years.

Orchid bark (which usually is the bark from redwood or Douglas fir), comes in 3 sizes (sizes are also referred to as 'grades"): small size (also known as "seedling" size), medium and large (or coarse) size.

The sizes used are mostly the seedling size and the medium size.

Bark is rarely used alone. Most growers add to it one or more of the following:

- perlite,
- sponge rock (which is expanded perlite),
- charcoal (horticultural grade),
- sphagnum moss,
- tree fern,
- peat moss,...

Perlite and sponge rock are used to create more air space in the mix .

Charcoal is used to absorb harmful materials that may be in the water.

Sphagnum or peat moss are used to increase the water holding capacity of the mix.

Sphagnum moss

Sphagnum moss (premium grade which is long fibered and completely free of debris and other materials) is an excellent material which is widely believed to have fungicidal properties. It is more expensive than orchid bark.

Sphagnum moss ***holds a lot more water than bark***, is not as easy to use and ***needs to be refreshed every year***.

Sphagnum moss comes mostly in two grades: fine (or seedling grade) and long fibered.

Tree fern

Tree fern, from the roots of a fern called "tree fern", is an excellent material that is relatively easy to use and will easily stay fresh for 3 years. The material is relatively expensive.

There are 2 varieties of tree fern: one is sort of light brown and flexible, is mostly available in Hawaii and is called Hawaiian tree fern, also known as "hapu", the other is dark brown and rigid and comes mostly from Central America. The latter is what is typically referred to as "tree fern" and, unless otherwise noted, when we mention "tree fern" we mean the rigid one from Central America.

Medium tree fern holds just about as much water as medium fir bark (fine tree fern holds more than fine fir bark), but by far not as much as sphagnum moss. It is more expensive than orchid bark.

Tree fern also comes in 3 sizes: fine (or seedling grade), medium and coarse.

Osmunda fiber

Was a choice material in decades past. Nowadays it is not as readily available and it is expensive. Furthermore, it comes in relatively large chunks that you have to cut into about 1/2" chunks in order to use it. Great exercise for the wrist but who has the time ? Furthermore, when using osmunda fiber you must make sure the fibers are aligned vertically so as to allow the water to drain.

Coconut chunks

Coconut has been widely used in Asia where it is readily available and is a renewable resource.

In the last few years it started being used in the US Coconut comes either in chunks (small and medium size) or in long fibers.

Coconut is more expensive than bark but it will last up to 5 years and is relatively easy to use.

One drawback of the coconut chunks is that, based on literature we read, it can be very high in sodium when first used (some say "depending on the source"). As it ages it apparently looses much of its sodium content.

Our experience using coconut chunks as a potting material is limited, but from this limited experience we found it ***holds the water much longer than bark and therefore we would suggest caution when using it.***

Coconut fiber

Coconut fiber, as far as we know, is not widely used to grow orchids. We use a ***thin*** layer of it to line Vanda and wire baskets to prevent other potting materials from falling out of the basket.

We also use it to "stuff" Vanda baskets when potting vandaceous orchids (Vandas and related) so as to hold just a little bit of moisture and to help hold the plant in place. Use it sparingly, and "fluff" it because if it is too dense it will stay wet and Vandaceous orchids hate this.

Lava rock

As far as we know it is mostly used by growers in Hawaii where it is plentiful.

We do not use straight lava rock as a potting material. We use a limited amount of lava rock as part of our semi-terrestrial mix (see potting mixes).

Charcoal

In the US charcoal is rarely used as the main or sole ingredient of the potting material. Some growers add charcoal to their potting material because charcoal absorbs toxins that may be present in the water and, as Eric A. Christenson wrote in his book "Phalaenopsis - a monography" charcoal will also absorb toxins released by the roots of plants.

Charcoal does not degrade easily so it will retain it's ability to aerate the potting material. If you are going to use charcoal, ***make sure to only use horticultural grade*** charcoal.

Pieces or cork / cork from bottles

Cork comes in relatively large pieces (slabs) and to use it as a potting material you'll have to cut it to useable pieces, may be about 1/2" in size, which is difficult, and could be dangerous. Same will go for cork from (wine) bottles.

We only use relatively large pieces of cork slabs (2" by 3", 4" by 6", 6" by 8"...) to ***mount orchids***.

Peat moss

We have no experience at all using this neither as the main ingredient nor as an additive. From what we read about peat moss it has a high water retention capacity and it does stay relatively intact for several years. Some growers include it as part of their mix.

Rockwool

Rockwoll is an inert material that looks like dirty cotton. There are 2 varieties of rockwool: one absorbs water, the other repels water.

Ten years ago or so we used water absorbent rockwool as part of our potting mix but gave up on it because it holds too much water and was difficult to mix. But the worse was its propensity to collapse which reduced the air space in the potting material.

Aliven (man-made clay pellets)

Several years ago we experienced with Aliven because it is inert, practically indestructible and it is easy of use (we could say the same about lava rock).

At first we thought we had a winner, but as plants stayed longer in it we realized new roots had a pronounced tendency to grow ***out*** of the pot and ***not in it.*** After a year or so we gave up on it.

2.5 Our potting mixes

We use the following potting mixes and / or potting materials: Mix A holds the most water, mix B a little less than mix A, mix C a little less than mix B and so on.

Mix A - Sphagnum moss

Mix B - Semi-terrestrial mix

Mix C - Fine bark mix

Mix D - Medium bark mix

Mix E - Medium tree fern

Mix F - Long fibered coconut husk

Mix A - Sphagnum moss

Premium quality, long fibered sphagnum moss, nothing else added.

Repot every year with this mix.

Mix B -Semi - terrestrial mix

The mix consists of
- -4 parts fine bark,
- -1 part sponge rock (= expanded perlite).
- -1 part chopped (1/2" to 1") sphagnum moss,
- -1 part fine tree fern,

A variation on this mix will include 1 part lava rock or Aliven or a similar material.

Unless specified otherwise (for specific plants), repot every two years with this mix.

Mix C - Fine bark mix

The mix consists of
- -4 parts fine bark,
- -1 part sponge rock (= expanded perlite).

Repot every two years with this mix.

Mix D - Medium bark mix

The mix consists of
- -4 parts medium bark,
- -1 part sponge rock (= expanded perlite).

Repot every two years with this mix.

Mix E - Medium tree fern

This consists of 100 % medium tree fern.

Repot every two to three years with this mix.

Mix F - Long fibered coconut husk

This consists of 100 % long fibered coconut husk. Fluff the material before using it because it is too dense as it comes. Being too dense will reduce air circulation and will hold water for too long.

Repot every three to five years with this mix.

We use this long lasting potting material :

- for lining Vandas baskets,
- for lining wire baskets for Stanhopeas or Vandaceous orchids,
- as a backing for some mounted plants,

Lining Vanda or wire baskets with long fibered coconut husks prevents the potting material (which can be medium bark, medium tree fern, coconut chunks,..) from falling through the openings of the Vanda or the wire basket. Use the material sparingly.

The composition of our potting mixes is available on a summary chart.

2.6 Potting orchids-general

Potting comprises 2 parts

1 - unpotting the plant from the old container and grooming the plant,

2 - re-potting the plant and staking it if necessary.

Unpotting the plant from the old container

Water the plant first as it makes it easier to remove the old potting material.

Retrieve the plant from the pot and remove all the old potting material.

Trim dead roots with sterilized shears or scissors.

You are now ready to (re)pot the plant, so let's see which potting material we'll use.

Which orchids to pot in sphagnum moss

When we mention "sphagnum moss" or "moss" we mean the ***premium quality long fibered***. We do not use the seedling grade, which to our opinion, does not allow for enough air circulation.

As a general rule we use sphagnum moss for potting:

-all Phalaenopsis up to pot size	-plastic pot 6",
	-clay pot 7"
-all other young plants up to a pot size	-plastic pot 2 1/2"
	-clay pot 3 1/2"

Mature miniature plants, such as Tolumnia, although potted usually in 2 to 3" clay pots, ***are not young plants*** and therefore ***we do not pot them in moss***.

See at the end of this section the chart "Potting Mixes" for which potting mix to use for other plants.

2.7 Potting monopodial orchids

2.7.1 Potting Phalaenopsis & other monopodial orchids in sphagnum moss

Place the roots in the pot. The ***plastic*** pot size should be ***just large enough to accommodate the roots***. If you use a clay pot, use a pot that's just one size larger

than the plastic pot, allowing for about 1" of space around the roots, ***a little more if you use a clay orchid pot***.

Center the plant and hold it so that the junction of roots and lower leaves is ***flush with the top of the plastic pot***, add peanuts to fill ***just below the inside rim*** of the plastic pot. If you are using a clay pot fill about 2/3 of the pot with peanuts.

Fluff the moss and fill with moss to the top rim of the pot ***without pushing too hard on the moss.***

While holding the plant from the base (where leaves and roots join), firm the moss down to the inside rim of the pot (if you are using a clay pot, firm the moss down to about 1/2" to 1" below the rim of the pot).

For best results moss must be well moist (but not dripping wet - if it's dripping wet squeeze the water out of it). When placed and firmed in the pot the sphagnum moss should pretty much stay in place. If it does not, then the moss is too dry.

When done the base of the plant should be just a little higher than the moss ***so that leaves do not touch the moss*** and the top of the roots are just a little bit exposed.

If you were to remove the plant from the pot, you should see no more than 1/2" to at most 1" of potting material in a 4" to 5" pot.

Trim yellow, shriveled leaves and parts of leaves with spots.

If necessary stake the plan so that it does not wobble. If the plant wobbles the roots will move every time you water or touch the pot and the roots will have a hard time establishing themselves. We like to use a 12 gage galvanized metal stake folded in two (U shape) to hold the plant in place. After two or three months we just pull out the stakes without disturbing the plant.

2.7.2 Potting Phalaenopsis & other monopodial orchids in bark

Place the roots in the pot. The ***plastic*** pot size should be ***just large enough to accommodate the roots*** plus about 1/2" space all around them. If you want to use a clay pot, use a pot that's just one size larger than the plastic pot, allowing for about 1" of space around the roots, ***a little more if you use a clay orchid pot***.

Center the plant and hold it so that the junction of roots and lower leaves is ***flush with the top of the pot***, then place a 1" to 2" (pot size up to 5") or 2" to 3" (pot size 6" to 7") layer of Styrofoam peanuts at the base of the pot, making sure to fill in between roots.

Add ***loosely*** the bark mix so as to fill to the top rim of the pot, then tap gently the side of the pot to settle the bark, then ***gently*** firm it down a little. Pushing ***too hard*** on the bark will ***crash the roots, so be gentle*** when firming it down.

2.8 Potting sympodial orchids

2.8.1 Potting sympodial orchids in sphagnum moss

On some sympodial orchids such as Cymbidiums, Jumeleas, Paphiopedilum, Phragmipedium, ... the new growth(s) will be very close to the base of the old growth(s), forming sort of a circle around the older growth(s).

The potting procedure for these type of young plants is the same as for Phalaenopsis.

But for many sympodial orchids, such as Cattleyas, Dendrobiums, Oncidiums,...the new growth(s) develop along a rhizome and ***usually*** tend to grow in the opposite direction of the old growth(s).

The procedure for potting these is the same as for Phalaenopsis except that instead of centering the plant you want the ***older portion of the plant as close to one edge of the pot as you can get it***, leaving room ***on the opposite side of the pot for the new growth(s).***

We said "usually tend to grow on the opposite side" because that's how they will develop most of the time, but occasionally the new growth will be more of less adjacent to the previous one. ***Examine how your plant grows to decide where to leave room for the new growth to develop.***

There are several ways to distinguish older growth from new growths :

1 - the color of new growth is usually ***lighter*** than the color of older growth,

2 - pseudobulbs of ***new growth*** are often flat until the (new) growth matures,

3 - the older growth is the smallest in size, and in many cases will be leafless.

When done the base of the plant or the rhizome should be just a little higher than the moss ***so that leaves do not touch the moss*** and the top of the roots are just a little bit exposed.

2.8.2 Potting sympodial orchids in bark

Pots should be large enough to accommodate the plant and allow for 1 or 2 years worth of growth (depending on how frequently you want to repot your plants). As for pot type, up to 6" we like to use Azalea (deep) pots, and above 6" we prefer to use pan (shallow) pots. This is to maintain a proper balance between root system and amount of potting material, so as to avoid plants staying wet too long.

On some sympodial orchids such as Cymbidiums, Jumeleas, Paphiopedilum, Phragmipedium,...the new growth(s) will be very close to the base of the old growth(s), forming sort of a circle around the older growth(s).

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We said “usually tend to grow on the opposite side” because that’s how they will develop most of the time, but occasionally the new growth will be more of less

adjacent to the previous one. Examine how your plant grows to decide where to leave room for the new growth to develop.

2.9 Care after repotting

Repotting can be as much of ***a shock to plants as major surgery is to humans***.

So for a few weeks after repotting a plant you want to nurture it a bit.

- Spray (mist) their leaves ***lightly*** twice a day for two weeks (healthy plants) to four weeks (weak and ailing plants). Spray early in the day and again ***no later than mid day*** (no later than 12 noon in the winter). Add to your misting water 2 or 3 drops of Superthrive and 2 or 3 drops of a rooting solution. If you do not have rooting solution add 2 or 3 drops of a fertilizer high in phosphorous such as .
- For 3 to 4 weeks you so place the newly repotted plants at a location where they will be getting ***less light than what they usually get***. The lower light levels will reduce the stress caused by the repotting shock and will help the plants recover better and faster.
- Do not water for a week after repotting. Water lightly (just enough to get the potting material moist, not enough for the water to run through the drainage holes) a week after repotting, adding to your water a few drops of rooting solution.
- As from a week later water thoroughly once a week.
- Use the rooting solution instead of fertilizer for the first 3 or 4 waterings after repotting.

3 Light levels for growing orchids

3.1 How is light measured / expressed

Light intensity is measured / expressed in various ways. One of the oldest measures of light is the **foot-candle** (abbreviated **fc**).

A fc is an old English measure. It defines the light projected by a standardized candle over an area of one square foot from a distance of one foot. Back then, before electricity, that's how people read, by the light of a candle.

Another way to measure light is by Klux (stands for kilo lux or 1,000 lux). The lux (plural luxes, abbreviated lx) is the International System unit of illumination, equal to ***one lumen per square meter***.

One ***fc is also one lumen*** but per ***square foot***. One Klux equals approximately 92.3 fcs.

Other methods for measuring light will be in mE/m2 = milli-einsteins per square meter per second, or in Watts/m2 = watts per square meter,...

Most books about growing orchids refer to light levels in fcs, so that's the measure we'll use for this chapter.

Orchids in the wild are widespread, growing in the dim light of a rain forest or in the bright light of a mountain slope. Therefore we'll encounter orchids that need relatively low light conditions, other that need moderate light and some that need bright light.

3.2 Misconceptions about light.

I often hear people say "I have my orchids in a very bright location, it's by a north facing window" or "my orchids get plenty of light, there are in the middle of the room under a skylight".

Sorry folks but what your plants are getting is what we, humans, consider bright light, but this is far from being bright light for your plants.

On a bright early September day, at noon, I measured the outside light and the light in a south facing kitchen. The outside light was 8,000 fcs. The south facing kitchen has a sliding door opening to the south. It has a 2 1/2 feet by 5 feet window facing south and it has a 3 feet by 5 feet skylight in it. The walls are light cream and the floor is light green-white tile. There are no trees or tall buildings to reduce the light entering this room. ***This is a bright room by any measure.***

Here are the results in fcs:

	By the sliding door	**By the window**
Against the unscreened pane	6,000	6,000
Against the screened pane	4,000	4,000
1 foot away (in the sunlight)	3,000	3,000
2 feet away (in the shade)	600	600
3 feet away (in the shade)	500	500
4 feet away (in the shade)	400	400
10 feet away, under the skylight	less than 200	less than 200

I also measured the light at a north facing window in the living room. The living room has an true east window, a south facing sliding door and a large window on the north side. Here are the light levels:

	By the east window	**By the north windo**
Against the unscreened pane	800	400
Against the screened pane	500	200
1 foot away from the window	450	Not measurable

As these measurements show the light levels drops ***very fast*** with as you move away from the sources of light and ***there is a vast difference in the amount of light depending on the exposure of the window***. Remember ***none of these windows is shaded by trees or other buildings***.

3.3 How light diffuses

Let me try to illustrate how light diffuses with an example. Let's assume we build a pyramid whose base is 8 feet by 8 feet and it's height is 8 feet. The construction is such that no light escapes from the inside and no light penetrates from the outside.

At the inside top of this pyramid there is a 1,000 watts light bulb emitting approximately 9,230 fcs of light (now remember that's the measure of light on ***a one square foot*** area at a ***distance of one foot from the light source***).

At the base of the pyramid the area illuminated by this bulb is 8 feet by 8 feet = 64 square feet. As it is ***the same amount of light*** (9,230 fc) that reaches this 64 SF area, the illumination in fc at the base of the pyramid is 144 fc (9,230 : 64).

Here is another way to illustrate this. Let's assume we have a square basin 1 foot wide and 1 foot tall. The volume of this bucket is one cubic foot of water. Let's imagine for the sake of our discussion that the height of the water can be converted into imaginary foot-candles and that 1 foot of water height equals 1 imaginary foot-candle. So if we measure the height of the water in the bucket we'll find it to be one foot and therefore one imaginary foot-candle.

Now let's pour our bucket of water in a square basin whose sides are two feet wide. The surface of this basin is 4 square feet. Simple math's will show that the height of the water in this basis will only reach 1/4 a foot which translates into one quarter of our imaginary foot-candle.

And if we poured this same bucket of water in a square basin whose sides are 3 feet wide, thus with a square surface of 9 square feet, the height of the water will only reach 1/9 of a foot which translates into 1/9 of our imaginary foot-candle.

Light, like the water in our basin, ***will fill all the available space at any given area***. Since the ***total*** amount of light is the same at any given area, the further away we are from the light source, the ***larger the illuminated area is*** and the ***less amount of light will fall on any given square foot of area***.

3.4 How to measure light

You can measure light with a light meter. Good ones are available between $ 80.00 and $ 150.00. Some measure light in foot-candles and others in luxes of Klux's

You can also use a 35 mm camera to measure light. Here is how to do it:

- Set the camera at 25 ASA.
- Set the shutter speed at 1/60 of a second.
- Place a white sheet of paper where the leaves of the plants would be.
- Focus on the white sheet of paper from a distance of 1 foot.
- Make a note of the f/stop shown in the viewfinder.

Here are the approximate foot candles corresponding to various f/stops:

f/2 = 100 fc
f/2.8 = 200 fc
f/4 = 375 fc
f/5.6 = 750 fc
f/8 = 1,500 fc
f/11 = 2,800 fc
f/16 = 5,000 fc.

Remember the ***maximum light*** should be at noon on a bright summer day.

3.5 What is low light, moderate light and bright light for orchids ?

Let's start with the maximum light : at noon, on a bright, cloudless summer day, the light level outdoors (in the northeast) will top 10,000 fc.

We usually consider the light in a supermarket to be bright. If we measured that light level with a light meter we'll find it's intensity is about 200 to 300 fc, and for us, humans, these 200 or 300 fc of light intensity in the supermarket are quite comfortable.

But 200 to 300 fcs of light is just a pittance for orchids.

To grow ***and*** bloom properly :	**Low end**	**High end**
• Low light orchids need	1,000 fc	1,500 fc
• Moderate light orchids need	1,500 fc	3,000 fc
• High light orchids need	3,000 fc	4,500 fc.

Please keep in mind these levels of light are for ***mature plants*** and the maximum light is for a limited time at the ***brightest moment of the day*** (noon in a bright, cloudless, summer day).

Please also keep in mind you can acclimate some of your orchids to grow a little outside of these ranges, within reason of course.

The book "An Introduction to Orchids - A Guide to the Growing and Breeding of Orchids" published by The South Florida Orchid Society(Tel 305-226-4757) and the book "All About Orchids" published by Ortho Books both have very clear charts about light requirements of orchids.

3.6 Where to grow you orchids at home

In practical terms what this means is that to provide the ***minimum light*** our orchids need to grow ***and*** bloom we'll have to grow them :

Low light orchids	-on the windowsill of an east window -or within 1 foot of a west windowsill -or within 2 feet of a south windowsill -or within 1 foot of a south windowsill if it is shaded by other plants or by shade.
Medium light orchids	-on the windowsill of a west window -within a foot of a south windowsill
High light orchids	-on the windowsill or within a foot of a south windowsill, (as long as they do not get direct sun in the middle of the day).

Please keep in mind we are talking about ***windows that are not shaded by trees or other buildings***.

3.7 Impact of light on your orchids

Your orchids will, ***to some degree***, adapt to their environment. You may be able to coerce a medium light plant to grow and bloom on a bright east windowsill but you'll have a real hard time blooming a high light plant on an east windowsill and very few, if any, will bloom on a north windowsill.

Orchids will tolerate levels of light on the higher end of their range provided the plant receives more water (more frequent watering), more fertilizer and, if possible, better air movement to keep their leaves a little cooler.

When we say more frequent watering we mean maybe every five days or so instead of every seven days, ***not every other day instead of every seven days***.

This does not mean you should subject your plants to ***excessive light***. If your orchids get too much light and not enough water and fertilizer, they will be stressed.

Stressed (weakened) plants have less defenses against pests and diseases the same way as weakened humans have.

Visible signs of stress are shriveling pseudobulbs and / or leaves, drying buds, prematurely wilting flowers,... Note that this kind of stress can also result from unproper potting, decaying potting material, insufficient watering,....

Watch the foliage of your plants. If the leaves stay green, are crisp and firm, then the light is probably right.

If the foliage is dark green, then the light is too low.

If the foliage shows purplish marks or coloration, then the light is probably too high.

Sometimes if the light is too high the tips of the leaves will dry up.

3.8 Light versus direct sunlight

Very few orchids will tolerate direct sunlight, except maybe for an hour or too after sunrise and an hour or two before sunset.

If you grow your orchids at a south or southeast or southwest location, in a sunroom or in a greenhouse, you'll have to provide some shade, at least for the brightest part of the day.

Surrounding trees or tall buildings may provide enough shade, sometimes too much shade.

And remember, there is a substantial reduction in the light from summer to fall to winter. Provide more light / less shade as from mid October to mid February to compensate for this natural reduction in light.

Finally remember that although plants will adapt to changing environments, they will adapt better, with less stress if you ***gradually ease into the new conditions*** (such as summering them in bright outdoors light).

3.9 Growing under lights

My personal experience is limited as the only plants I grow under lights are my flasks, but here is some information to get you started.

3.9.1 Spectrum (colors) of light and it's impact on plants

If you look at a rainbow which diffracts the components of light you'll see the various colors of the spectrum of light.

Natural light comprises ultra-violet, violet, blue, green, yellow, orange, red and far-red light. And there also is invisible infra-red light.

To us, humans, the green and yellow parts of light are what is important for our vision, but these colors are not that important to plants.

For plants, blue, red, far red and infra-red light are the important parts of light.

The blue and red rays of light are necessary for plants to photosynthesize.

Red light affects maturation, ripening and dormancy of plants. Far red is necessary for plants to grow. Far red and infra-red affect cell activity, stimulate plant growth and development of new leaves and roots.

3.9.2 Horticultural Vs household lamps

If we plan on growing under lights we have to pay attention to the spectrum of light emitted by the lamps.

Horticultural lamps have been devised to meet as best as possible the types of light necessary for plant development which of course is not true for lamps developed for human use as our light needs are not the same.

Horticultural lights are available as fluorescent lights and bulbs.

3.9.3 Output of light bulbs

3.9.3.1 Fluorescent lights

Fluorescent lights are mostly rated in the 20 to 40 watts which translates into something like 185 to 370 fc of light.

Using several fixtures together will barely produce enough light to grow low light orchids (Phalaenopsis, mottled leafed Paphiopedilums,...) and then only if the lamps are set only 8" to maximum 12" above the foliage.

3.9.3.2 High intensity lamps

As their name indicate these lamps emit substantially more light than fluorescent lights. There are lamps of 100, 250, 400, 600 and even 1,000 watts, emitting anywhere from 1,000 to over 9,000 fc.

These bulb lamps ***require special lighting fixtures*** that can cost anywhere from $ 150 to over $ 500.

Replacement bulbs cost anywhere from $ 35 or so for a 100 watt lamp to over $ 100 for a 600 watt lamp. Most of them are rated for 10,000 hours of use which at 14 hours per day will last more than 2 years, so the cost of a 600 watt bulb is something like

$ 0.15 per day)

There are several brands available (HydroFarm, Sun Systems, Philips Lightning,...).

These fixtures can be combined with a rail system which moves the fixtures back and forth on a straight line or that rotates the fixture allowing a greater growing area.

Keep in mind the properties of light : at 2' from the lamp you'll get 1/4 the light emitted by the lamp and at 3' you'll get 1/9 of the light emitted by the lamp.

Many people have great success growing under lights, in poorly lightly rooms, in basements, ...

The biggest challenge of growing under light is managing the day & night temperatures, the humidity and the air movement which is necessary to prevent hot spots on the leaves.

3.9.4 Getting more information about light fixtures

Some of the information provided above was derived from the book “Growing Orchids Under Light” (by Charles Marden Fitch, published by the American Orchid Society, Tel 561-404-2000, web: orchidweb.com) which I suggest you buy if you are interested in growing under lights.

Also you may want to ask for the Charley’s Greenhouse and Garden catalog (Tel 800-322-4707, web : charleysgreenhouse.com) or for the Worm’s Way catalog (800-274-9676, web : wormsway.com) as both feature an extensive line of horticultural lights and light fixtures.

4 Temperatures for growing orchids

In nature orchids inhabit various habitats, from low land rain forests to mountain slopes, to swampy areas. Therefore we can expect some orchids to need the warm conditions of a tropical rain forest, others to need the cool conditions of a slope on the foothills of mountains and yet others to have needs somewhere in between.

Orchids are classified in 3 temperature groups: orchids that require cool temperatures, other that require intermediate temperatures or others that need warm temperatures.

Here are the temperature ranges for the three groups, and please don't hold me to the degree, as you'll most probably see different ranges somewhere else:

	Day time		Night time	
	Winter	Summer	Winter	Summer
Warm growing orchids	70	85	60	75
Intermediate growing orchids	65	80	55	70
Cool growing orchids	60	75	50	65

Please notice the difference between day time and night time temperatures. In the natural world it is, most of the time, warmer in the day and cooler at night.

So when you grow your orchids keep this in mind, especially if you grow them in a bathroom which many of us, in the winter, tend to warm in the morning, then let it cool during the day, then warm it again at night.

But remember these temperatures are ***ideal ranges*** and, ***within reason***, you can acclimate your orchids to grow pretty well a few degrees outside of these ranges.

Your warm growing orchids will not die if they are subjected to day time temperatures of 90 degrees for a few days or to 55 degrees for a few nights. But at these temperature levels your orchids will ***stop growing*** and will ***become more susceptible to insects and diseases***, because there will be under stress.

5 Humidity levels for growing orchids

5.1 How much humidity ?

Most orchids require 60 % to 80 % humidity. These humidity levels are necessary for the plants to perform at their best and reward you with blooms that stay perfect for the longest possible time.

Although these levels may appear high, they are in fact well within the comfort zone for people which is 40 % to 70 % relative humidity.

In the summer time the natural humidity is usually sufficient to meet the needs of your plants, except on bright, sunny, dry days.

Air conditioning in the summer and artificial heat in the winter, especially from forced air heating and electrical baseboard heating, will dry the air well below the need of your orchids.

Plants placed in the path of air conditioning or in the path of forced air heating or next to a radiator or next to a heat source such as a refrigerator can get quickly desiccated, loose their buds and even their leaves in just a few days.

Consider investing a few dollars in a hygrometer to help you evaluate your conditions.

5.2 Increasing humidity around your plants

If your humidity levels are consistently too low, consider buying a humidifier. A cool mist humidifier can cost as low as $ 20 to $ 25 and will help considerably in maintaining the health of your plants.

Another way of increasing humidity is by setting your plants on trays filled with pebbles or gravel and with water, as long as the plants are not in contact with the water.

For this to be effective the trays must be wide enough so that the leaves of your plants are over the tray (from where the humidity will raise).

A tray for a single plant will not be of much help as the little humidity rising from it will disperse very fast.

Ideally you want to have a dozen or more plants grouped together as they will create a micro climate with higher levels of humidity.

In my opinion, the humidifier is the better solution. But if you use one make sure the mist does not blow directly on your plants as this will eventually wet them and promote bacteria and fungus growth that may well kill your plants.

6 Fertilizing orchids

6.1 Introduction

When I started growing orchids I bought a few books to learn about their culture.

What I understood about fertilizing was :

- fertilize with high nitrogen plants that are potted in bark,
- fertilize with a balance fertilizer plants that are potted in other media.
- use a high phosphorous fertilizer to promote flowering & root formation.

Recommended dosage was 200 PPM nitrogen (for plants in bark).

Some of the questions that came to mind were :

- what PPM nitrogen for plants in media other than bark ?
- should the fertilizer dosage be the same year round ?

Then as I read more and more about orchids and fertilizing I started being confronted with more issues :

- TDS (total dissolved solids)
- PH.

And I heard that some growers recommended the use of Epsom salts, the occasional use of a fertilizer called Mag Pro, the application in the summer of another fertilizer, Peter's Cal Nitrate, and yet another fertilizer, Peter's Plant Starter during potting,...

At times I got thoroughly confused.

6.2 Contents of fertilizers

All fertilizers contain as principal ingredients Nitrogen, Phosphorous and Potassium, which are commonly referred to as N-P-K.

The percent of these elements are shown on the fertilizer container as 3 numbers separated by dashes, always in the order N-P-K. For example: 30-10-10, 3-12-6.

In a 30-10-10 formulation, 30 % of the contents are Nitrogen, 10 % are Phosphorous and 10 % are Potassium.

In a 3-12-6 fertilizer, 3% of the contents are Nitrogen, 12% are Phosphorous and 6 % are Potassium.

Nitrogen fertilizer is derived either from urea, ammonia or from nitrates. Nitrogen ***derived from urea is not readily available to orchid plants***, therefore the Nitrogen in the fertilizers we use must be derived from ammonia or nitrates, ***not from urea***.

Fertilizers are basically made of minerals which are an essential ingredient of proteins. All living things need minerals. We, humans, find many of the minerals we need in fruits and vegetables, in meat, fish, vitamins...

Plants also need minerals and that's what fertilizers will provide.

<u>Nitrogen</u>

Is an essential element for the chlorophyllian function, that is for the leaves to convert light and nutrients into carbohydrates.

Nitrogen is necessary for the plant to grow. But excess nitrogen will cause plants to grow excessively in size and may delay flowering (think of those Vandas !).

On the other hand nitrogen deficiency will result in stunted plants.

A recent study by Dr. Yin-Tung Wand of Texas A & M University suggests that "under severe nitrogen deficiency, the proteins in the lower leaves are digested and the nitrogen is transferred out of the older leaves into the younger upper leaves (note : of Phalaenopsis). As a result some of the lower leaves start turning yellow and eventually fall off".

Phosphorous

Is believed to regulate many activities.

It is necessary for the formation of cells, it promotes root growth, it induces and stimulates flowering.

Deficiency is phosphorous will also result in stunted plants, with dark green leaves.

Potassium

Is necessary for healthy growth. Deficiency may result in dwarfness.

Micronutrients

Besides the essential elements (Nitrogen, Phosphorous and Potassium), plants need other minerals such as calcium, magnesium, iron, manganese,...usually referred to as "trace elements" or "micronutrients" because plants need them in much lower concentrations than Nitrogen, Phosphorous or Potassium.

An ideal fertilizer is one than contains the essential elements and all the micronutrients plants need.

6.3 Organic vs. inorganic fertilizers

Organic fertilizers such as guano and cow manure must be decomposed by bacteria before the nutrients they contain can be absorbed by plants (the same applies to nitrogen from urea).

Decomposition does not occur readily in the type of potting materials used for growing orchids, therefore organic fertilizers are not suited for orchids.

Also, unprocessed organic fertilizers can host diseases that will affect our plants.

For these reasons, we use, as our basic fertilizers***, inorganic*** fertilizers.

They may be benefits in an occasional application of organic fertilizers such as fish emulsion, but we are not experienced in their use or effects, therefore we have not included them in our regular fertilizer program.

6.4 Which fertilizer(s) should we use ?

I don't know how many different formulas of fertilizers there are, but there are a lot. So which fertilizer(s) should we use ?

Fertilizer chart 1

Here is a chart of the fertilizers we are using in 2002.

As you can see we basically alternate between high nitrogen (10 - 5 -5), high phosphorous (3 - 12 - 6) and balanced (7 - 7 - 7) fertilizers.

In the beginning of the summer we make 2 applications of 15 - 0 - 0 for additional calcium, and in the summer time we use more frequently the high nitrogen.

But this is only part of the story.

6.5 Should we use the same amount of fertilizer year round ?

Fertilizer chart 2

Because one of the other questions in our mind was should we give our plants the same amount of fertilizer year round ? Do they need the same amount when they get 14 hours of strong light as when they get 8 hours of low light ?

I do not remember getting or finding a clear answer to this question, but it seems logical to me that orchids (and all plants) could not possibly use the same amount of nutrients on a short winter day as on a long, sunny, summer day.

We found in the August 1998 issue of the magazine Greenhouse Product News a table of illumination, by month, for the Northeast. We adjusted this table to a weekly schedule and used it to determine the amounts of fertilizer we should give our plants. This is what Fertilizer chart 2 shows.

6.6 Hormones, vitamins and other additives to the water

We can not talk about fertilizers without mentioning some other useful additives.

Superthrive

Makers of Superthrive claim their product achieves miracles. We do not know from first hand experience but we hear from a lot of people that it is very beneficial.

Robert Fuchs, a commercial grower in Florida, claims that continuous use can cause mutations, so he limits it's use to once a month application.

Pro-Tekt

Consists of 3.7 % soluble potash and 7.8 % silicon derived from potassium silicate.

Field tests have evidenced silicon improves heat & drought tolerance.

In addition Dyna Grow (manufacturer of Pro-Tekt) claims it increases resistance to environmental stress, enhances healthier, stronger growth, and produces hardier plants.

Considering several field tests confirm the better results achieved when adding silicon, we made it part of our fertilizer program.

KLN

A rooting hormone that was developed by Dyna Grow to promote root formation on cuttings.

Dave Neil of Dyna Grow recommends to use it for 3 waterings after repotting plants.

He also recommends to use it monthly as a maintenance to promote stronger root growth.

6.7 Determining how much fertilizer to use in a gallon of water.

But how much fertilizer should we put in a gallon of water.

This depends on what kind of ***nitrogen*** PPM we want to achieve.

Here is how to calculate the amount of fertilizer to add ***to 1 gallon of water*** in a watering can:

A-Determine the desired nitrogen PPM. For example: (PPM = parts per million)	100	200
B-Find out the % nitrogen in the fertilizer As in Dyna Grow 10-5-5	10 %	10 %
C-Number of oz in a gallon (we started saying this calculation was for one gallon of water)	128	128
D-# of oz of fertilizer required per gallon of water is =A divided by B : 100 / 0.10 or 200 / 0.10 further divided by 1,000,000 (to get ***P***arts ***P***er ***M***illion) multiplied by C (the number of oz in a gallon).	0.128	0.25

Of course an easy way is just to follow the instructions on the fertilizer container.

If you decide to follow the instructions on the fertilizer and if they give you a range, such as 1/4 teaspoon to 1/2 a teaspon per gallon, then use the higher dosage in the summer and the lower one in the winter.

7 Watering orchids

7.1 Quality of water

The quality of your water is extremely important for good culture. In nature plants are drenched by rain water. Rain water results from evaporated water and unless it is heavily polluted (like acid rain), that water is very pure.

Rain water is slightly acidic with a PH factor of 6.4 to 6.8.

Tap water is usually quite acceptable.

Well water is acceptable if its content in mineral salts is below 120. Hard water (water with mineral contents above 120 PPM) will create hard deposits on the leaves of plants. This may clog the pores on the leaves of plants and reduce perspiration. If your water is hard it may be beneficial to periodically (once to twice a year) clean the leaves with distilled water.

Be careful with water that was softened. There are 2 basic products for softening water: salt and potassium chloride. Salt adds sodium to the water and, over the long term, this can be deadly to your plants. Potassium chloride will not harm the plants.

The best water is water processed through a reverse osmosis system which will remove most of the minerals from the water. Our well water has over 1,000 PPM (or TDS - ***Total Dissolved Solids***) of minerals in it (calcium, ...). We soften it first then we process it with a reverse osmosis (**R.O**.) system. The processed water has a mineral content of less than 20 PPM. (Note : if you use an R. O. system then softening the water with salt is fine because the R. O. process will eliminate practically all the sodium).

A small home R. O. system producing 30 gallons of water per day costs from $ 150 to $ 300 (Nature's Way - 800-780-2320). Nature's Way offered these systems on sale in September for $ 119 instead of $ 142.50 and $ 279 instead of $ 329.00.

I am not familiar with Nature's Way system. Our commercial system can produce 1,500 gallons per day. The processed water is stored in 1,000 gallon tank and must be pressurized before we are able to use it. I just mention this to make you aware that you might need something to storing the water if you consider an R. O. system.

7.2 How often to water

Here are some general rules for potted plants :

- The potting material should never be soggy. Water potted plants sufficiently to prevent them from becoming bone dry.
- In general water once a week, but be aware that small pots (5" or less) need more frequent watering than large pots (6" or more).
- Remember that different potting materials and different size potting materials will dry at different rates.
- Also remember that clay pots will evaporate more water than plastic pots and, everything being equal, will dry faster than plastic pots.
- And remember that clay orchid pots, because of their openings, will dry out faster than regular clay pots.
- Conditions are different from room to room. If you move your plants, observe them to see if your watering needs adjustment.
- If you place plants in decorative containers (china pot or decorative basket) to enjoy them while they are in bloom, keep in mind this will very probably slow down the evaporation of water and plants will stay wet for a longer time.

- Finally temperatures, light air conditioning and heating will affect how fast the potting material dries out. Be ready to adjust your watering habits as the season changes, especially from spring to summer and from fall to winter.

7.3 When and how to water your orchids

No matter how careful you are when watering, some water may and will get in between leaves or new growth. If this water stays there overnight, when temperatures become cooler, it may promote the growth of bacteria and fungi that may kill your orchids or the new growth of your orchids. To reduce risks of this happening you should adopt sound watering practices.

- Water only on sunny days. If the weather is cool, cloudy or rainy, you'll be much better off waiting a day or two before watering.
- Water early in the day. This will allow any water that got in between leaves or new growth to evaporate before nightfall. In our greenhouses we stop watering at 2 PM in the summer, at 12 noon in the winter and at 1 PM in the spring and fall.
- Water your plants with room temperature or lukewarm water as a difference of 10 degrees or more between the temperature of the water and the room temperature may cause injuries to the plants.
- Water from the top till the water runs freely through the drainage holes or immerse the plant in water up to 1/2" or so below the rim and let it absorb water for 10 minutes or so.

Wipe out any water that splashed on the leaves or in between the leaves. Using a straw is a convenient way of focusing the flow of air to blow out water from in between leaves.

7.4 Influence of PH on nutrient availability.

So far we discussed fertilizers, the proper dosage of fertilizers and proper watering, but giving the proper fertilizer in the proper dosage is only part of the issue. We need to make sure the nutrients ***are made available for the plants to use***.

Nutrient availability to plants is affected by PH levels. See chart on page 15 of "An introduction to Orchids" published by the South Florida Orchid Society.

As an example, Phosphorous is practically ***not available*** to plants in the PH range of 7.0 to 8.5. Availability of the trace element Manganese is mostly available between a PH level of 4.0 to 5.5. Boron between a level PH of 4.5 to 6.0.

The above mentioned chart (produced by Michigan State University) shows that most nutrients are available ***at their optimal level between a PH level of 5.0 to 6.0.***

An article in the fall 1997 issue of Greenhouse Grower, although not about orchids, states: "When the PH of the media is too high, micronutrient deficiencies can be a problem. If the PH is too low, micronutrients become more available and can lead to micronutrients toxicity in some crops."

Even if we started with water with an acceptable PH, the PH ***will change, up or down, depending on the additives*** (fertilizer, root solution, ...) we used. So, ***after we added all additives***, ***we must adjust our PH*** to a level that will make these nutrients and other additives available for the plants to use.

Most orchid sources recommend a PH between 5.5 and 6.5 for orchids and that's what we aim at ***after*** adding nutrients and / or other additives (i.e. Zerotol, Protekt,...).

7.5 How to adjust the PH of your watering solution

First of course you have to have a way to measure the PH of the water. This is done with a PH meter which you immerse into the (well) stirred water containing all your additives. A PH meter costs from about $ 65 to over $ 100.

Two products are available for PH adjustment from Growth Products in White Plains, NY (800-648-7626). PH booster (0-0-25 liquid potassium) raises the PH while Citric Acid Solution reduces the PH. Go slow ! a few drops in a gallon can make quite a difference !

7.6 The final word about fertilizing

The final word about fertilizers is from Rebecca Tyson Northen in her book Home orchid growing :

“After trying several (fertilizers) on your own plants, you yourself may come to have a preference for a certain one. This is good. Is shows that all is in rapport between you and your plants.”

8 Pests and diseases

8.1 Prevention, the best defense

The best defense against pests and diseases is growing healthy plants through sound culture and proper sanitation. But even so, once in a while you may have to deal with pests.

Pests

Fortunately not too many pests will affect your orchids, but some of them will take determination to get rid of. The insects that may affect your orchids are mostly mealybugs, scale, aphids, fungus gnats, spider mites, thrips and slugs / snails.

Check your plants after summering them outdoors

Before bringing your plants indoors again, check the leaves, under the leaves, around flower spikes, behind flowers and just under the rim of the pot for any sign of pests.

Chewed up leaves are a sure sign of damage from slugs or snails.

If you have summered your plants outdoors, even if you do not see any sign of insects you should consider treating them against insects before bringing them in.

Check your plants periodically

It is a good idea to check your plants periodically for any sign of insects. It is much easier to eliminate insects before they severally infest your plants.

8.2 Pests that may affect your orchids

Scale

The two most common scales that may affect your orchids are the soft scale and the armored scale.

Soft scale may hide in dried sheaths at the base of pseudobulbs of Cattleyas or similar plants. Remove the dried up sheaths to eliminate hiding places for them. Remove as many of the scale as you can see, then treat with an insecticide.

Hard scale looks like tiny turtles. They will usually be under the leaves of Phalaenopsis or Cattleyas, sometimes hiding in the pot. Remove as many as you can see, then treat with an insecticide.

Mealybugs

They are white and look sort of cottony, may be 1/4" in size. They can be on or under the leaves, on flower stems, on buds, behind flowers, in the pot,.... Remove as many as you can see, then treat with an insecticide.

Removing as many of the above insects as you can.

For all of the above use a soft toothbrush or cotton swabs to remove as many of the insects as you can. Dip your toothbrush / your cotton swabs in alcohol before using them to remove the insects.

Aphids

The mots persistent of them, as they reproduce on a short, 3 day cycle. Usually found on new growth, new leaves, on flower stems and flower buds, they suck the juices out of the plants and can cause substantial damage and leave marks on the leaves. Because they fly it is difficult to remove them individually. In warm sunny weather take the plant outside and use a garden hose to shake them off the plant. Then treat with an insecticide.

Fungus gnats

Look like small black flies. Are mostly hiding in the pot and fly our when you water. They are attracted by potting material that stays damp and by decaying plant material (dead roots, leaves,...). They feed mostly on dead plant material but they may attack roots, especially those of Cymbidiums. Because they hide in the pot you can not remove any. You have to treat them by immersing the pot in an insecticide solution.

Spider mite

Are very small and can not be seen individually without a magnifying lens. You can detect them by looking under the leaves for tiny silvery pits where they have sucked the plant juices. Another way to see if they are any is to place a white paper towel under the leaf and rub the leaf to make them fall on the paper towel. Spider mites will thrive in dry (too low humidity) environments. The best defense is maintaining reasonable humidity, but if you have spider mites you'll have to treat them with an insecticide / miticide. For best results immerse the pot in an insecticide / miticide solution.

Thrips

They do not occur frequently, but if they do, you'll notice it because of deformed or spotted flowers. They are difficult to eradicate because they tend to lodge in the flower buds and under sheaths where they are protected from insecticide sprays.

8.3 Treating insects with an insecticide.

Caution - Warning

If you are going to use commercially available pesticides please ***always follow the directions on the label***. Some of these insecticides are ***very potent and you should make sure to apply all required precautions against*** poisoning yourself, others around you or your pets.

You can prepare a safe, effective insecticidal soap by mixing 1 teaspoon of a mild liquid dishwashing detergent (the 409 cleaner, regular, works very well) to a quart of lukewarm water.

How insecticides work

Systematic insecticides are to some degree absorbed by the plant and may offer residual protection for a few weeks. Systematic insecticides tend to be more dangerous than other insecticides.

Many insecticides kill only the adult insects, not necessarily the eggs or the larvae (immature insects).

Insects develop resistance to insecticides. What this means is that some of them are not affected by the insecticide and these will reproduce. Treating these with the same insecticide will not kill them.

To avoid resistance you should consider rotating insecticides, that is you make the first application with one insecticide, the second application with another and the third one either with the first insecticide or with a third one. Rotating is not necessary with the insecticidal soap you prepare because this insecticidal soap works by suffocating the insects.

Treating for a limited infestation

If the infestation is not excessive, spray thoroughly the new growths, leaves (both sides), flower stem, back of buds and flowers with the insecticidal solution.

Treating severe infestations

If the infestation is widespread dip the hole plant for 15 minutes of so in the insecticide solution.

8.4 Making sure the treatment is effective

For the treatment to be effective you have to treat the plant (spraying or immersing) ***3 times***, at intervals of one week (intervals of 3 - 4 days for aphids).

The reason you need to make more than one application is because the insecticide will kill the adults and a few days later the eggs will hatch and the cycle restarts unless you treat again to kill the hatches. Most of the time three applications one week apart (3 - 4 days apart for aphids) will eliminate the insect population.

Caution !

If you are going to immerse plants in a solution :

- do it only on sunny days; if the weather is cool, cloudy or rainy, you'll be much better off waiting a day or two before treating your plant(s),
- do it early in the day; this will allow any water that got in between leaves or new growth to evaporate before nightfall,
- do it with room temperature or lukewarm water as a difference of 10 degrees or more between the temperature of the water and the room temperature may cause injuries to the plants.

Slugs

These are tough to treat as they emerge at night. In the old days the products to treat them were base on formaldehyde, a noxious product. Today you can treat them with a very effective and safe product called sloggo, available either in granular or liquid form.

The product is available from Monteray Lawn & Garden Products, Fresno, CA (www.montereylawngarden.com; Tel. 559-499-2100).

8.5 Diseases

Viruses

Occasionally you may come across a plant that has a virus. This may manifest itself by concentric or elongated black or brown or discolored circles on the leaves or black streaks on flowers and leaves. These will be repeated on all leaves / flowers. New leaves / flowers will at first appear free of it but as they age the virus will manifest itself. Unfortunately there is nothing you can do but discard the plant.

Bacterial and fungal diseases

These will appear if water stays in between leaves or if the potting material stays soggy, especially when the night temperatures are cooler (fall, winter, spring).

You can treat these with fungicides like RD 20 or Physan 27, but the best way is to avoid these problems by practicing proper culture.

9 Cultural problems

9.1 Cultural problems common to most orchids

9.1.1 Leaves

Leaves are dark green, look very healthy, but plant does not bloom:

Probably due to insufficient light. Check your light level, move the to within one to one and a half feet of a bright, unobstructed windowsill (window exposure depends on type of orchid).

Leaves are not as lustrous, eventually they shrivel:

plant is not absorbing enough water. Check the root system. If roots are abundant, look healthy, are firm and are white, then the plant is being underwatered. If the root system does not appear healthy repot as soon as possible.

Yellowing of leaves = chlorosis.

May be due to excessive light and/or deficiency in nitrogen.

Clear or watery spots on leaves:

usually result from bacterial infection. Repot plant, treat plant with a fungicide, keep it on the dry side for a few weeks.

Discolored area on top of curled leaves or on leaf area exposed to light:

most probably due to sunburn or excessive light for this type of orchid.

Pitting on new foliage:

tissue collapse due to use of too cold water or because of too cold temperatures.

Tips of leaves are burned (black), roots are withered:

plant is overfertilized or burned by fertilizer. Check your fertilizer dosage, make sure you water thoroughly with plain water once a month, make sure you do not water with fertilizer when the plant is completely dried out.

Leaves turn yellow, then brown and die:

probably due to fungi, as a result of excessive watering/soggy or decaying potting mix and/or excessive humidity possibly combined with too cool temperatures. Unpot the plant, treat it with a fungicide, cut dead / brown growth and leaves, repot in fresh potting mix. Allow the plant to dry in between waterings.

Black streaks on leaves :

may be caused by a number of cultural problems or by a virus. If due to a virus, this will eventually show up on all growths. Newly developed growth may at first appear normal, but eventually they will display same symptoms. If this a plant you particularly like, you may have it tested for virus. ***Plants can not be cured from viruses***, and viruses may be transmitted to your other plants through insects, water splashing from plant to plant, or from grooming without sterilizing instruments. If the plant has a virus, it's best to dispose of it.

9.1.2 Leaves or new growth

Soft, rapid growth:

may be due to excessive nitrogen

New growths are smaller, not as plump than previous ones, are stunted, do not grow upright:

the plant is under stress, either because of weakened root system or

insufficient light or too extreme temperatures, deficiency in nitrogen, or a combination of these. Check light, temperature levels & fertilizer dosage. Repot if needed.

9.1.3 Buds, flowers & flower spikes

Buds yellow and drop:

extreme temperatures, extreme or insufficient light, drafts, too dry air, inadequate watering, micronutrients deficiency or excesses or weak root system.

Flowers do not open up fully:

may be due to genetics, or by too low temperatures, or may be due to too low humidity or thrip damage.

Flowers are too small, colors are not as strong as before:

most probably due to insufficient light, and or too extreme temperatures**.**

Flowers fade too fast:

may be caused by too high or too low temperatures, exposure to direct sunlight, exposure to drafts, too low humidity, fertilizing or micronutrients deficiency, inadequate watering or poor condition of the root system.

Too few flowers:

weak plant, too low light, phosphorous deficiency.

Brown streaks or mosaic patterns on flowers:

may be due to a virus.

Poor display of flowers:

When buds start to form on the flower spikes, be careful not to change the orientation of the flower spike (which leans toward the source of light) so as to get the best possible display of flowers.

9.1.4 Roots

Are black or brown:

may be damaged (broken) or have rotted (root rot fungus). Cut damaged & rotten roots. If rotted, treat with a fungicide, repot plant, keep a little drier.

Chewed or missing tips:

chewed by pests (millipedes, sowbugs, snails or slugs).

Dead tips:

may be caused by salt built-up due to too hard water or excess fertilizer or not leaching medium regularly.

Deformed:

may be due to chlorine deficiency.

Stunted roots:

probably because of micronutrients deficiency.

9.2 Cultural problems-Phalaenopsis

9.2.1 Leaves

New leaves are smaller than previous ones: the plant is under stress, either because of weakened root system or insufficient light or too extreme temperatures or a combination of these. Check light and temperature levels. Repot the plant if needed.

Crinkled leaves: may be due to insufficient watering.

Limp, dull, eventually wrinkled leaves: the plant is not absorbing enough water, either because of a poor root system or because of inadequate watering. Check root system, repot, water as required.

Reddish leaves: is often normal on the underside of leaves. On the upper side it may be due to excessive light, or deficiency in nitrogen and/or deficiency in phosphorous.

Red coloration on new foliage: may indicate a fungus. Treat with a fungicide.

Reddish or discolored bottom leaves: bottom leaves are dying back. May be normal when new leaves are formed. Mature plants carry from 4 to 6 leaves, and replace 1 or 2 per year. May be also a result of repotting shock, especially if newly repotted plants are not misted and if they are subject to too high light.

No or limited new leaves: often result from nitrogen and/or phosphorous deficiency.

Leaf loss: if it is not due to aging while new leaves are being produced, is an indication of stress which may result from extremes in temperatures, humidity, watering or phosphorous deficiency. Treat plant with a fungicide/germicide, repot in sphagnum moss, keep at very high humidity (enclose in plastic bag?). This will probably not revive the plant but is may induce it to produce keikis.

9.2.2 Flower spike, buds, flowers

Flower spike is c*rooked or discolored*:

may be due to a virus. Isolate plants until final diagnosis.

Limp spikes:

may be normal for some species and resulting hybrids, otherwise indicates too low light.

Too short flower spikes:

usually due to excessive light.

Spikes turn brown at the tip:

were subjected to too cold water, resulting in collapsing tissue.

Spike develops keikis:

normal for some species, but can be cause by too high temperatures, insufficient light, decaying potting medium, plant in poor health.

Thin flower spikes:

may be due to phosphorous deficiency or too low light.

Flowers rot or are spotted:

caused by fungi if water is allowed to stagnate on them or because of excessive moisture/humidity.

You can help the plant by cutting the flower stem after flowers have faded. Removing the spike after flowers have faded will induce plant to generate more and larger flowers at its next blooming season.

Plants getting right conditions will spike more or less naturally in late fall or winter or early spring. You can induce flowering by subjecting plants to 2 or 3 weeks of night temperatures in the mid to low 60's. Flower spikes should appear about six weeks later.

9.3 Cultural problems - Cattleyas

9.3.1 New growth & leaves

Growth turns brown, then dies:

probably due to fungi, as a result of excessive watering/soggy or decaying potting mix and/or excessive humidity possibly combined with too cool temperatures. Unpot the plant, treat it with a fungicide, cut dead / brown growth and leaves, repot in fresh potting mix. Allow the plant to dry in between waterings.

No or limited new growth:

may result from nitrogen and/or phosphorous deficiency, or damage / rotting of growth buds (at basis of previous growth).

9.3.2 Flower sheath, buds & flowers

Sheath dries out:

may be because plant was immature (1st attempt at blooming) or may be species related as some Cattleyas will bloom after the sheath has dried out.

Sheath and/or buds turns brown and are watery:

water stagnated in/on the sheath and provoked sheath and probably buds) to rot. Gently open sheath to check if buds are still green. If yes, completely open sheath to expose buds . If buds are yellow or brown, remove sheath & buds. In either case make sure water does not gather and stagnate there.

9.4 Cultural problems - Cymbidiums

9.4.1 New growth, leaves

New growths are smaller, not as plump than previous ones, are stunted, do not grow upright: the plant is under stress, either because of weakened root system or insufficient light or too extreme temperatures, deficiency in nitrogen, or a combination of these. Repot the plant, check light, temperature levels, fertilizer dosage,....

Leaves turn yellow and die:

probably due to insufficient watering

Growth turns brown, then dies:

probably due to fungi, as a result of excessive watering/soggy or decaying potting mix and/or excessive humidity possibly combined with too cool temperatures. Unpot the plant, treat it with a fungicide, cut dead / brown growth and leaves, repot in fresh potting mix. Allow the plant to dry in between waterings.

No or limited new growth:

may result from nitrogen and/or phosphorous deficiency, or damage / rotting of growth buds (at basis of previous growth), or poor root system, but often due to poor repotting or overdue repotting.

9.4.2 - Flower sheath, buds & flowers

Sheath and/or buds turns brown and are watery:

water stagnated in/on the sheath and provoked sheath and probably buds) to rot. Gently open sheath to check if buds are still green. If yes, completely open sheath to expose buds . If buds are yellow or brown, remove sheath & buds. In either case make sure water does not gather and stagnate there.

Buds dry and drop:

Bud drop may occur if day or night temperatures are too high. Ideally when buds start to develop (usually in fall or winter), day temperature should not go much above 65 F and night temperatures should, if possible, be maintained between 50 F and 60 F.

Flowers yellow and drop:

extreme temperatures, extreme or insufficient light, drafts, too dry air, inadequate watering, micronutrients deficiency or excesses.

9.5 Oncidiums and intergenerics with Oncidiums

9.5.1 New growth, leaves

New growths are smaller, not as plump than previous ones, are stunted, do not grow upright:

the plant is under stress, either because of weakened root system or insufficient light or too extreme temperatures, deficiency in nitrogen, or new growth growing over the edge of the pot, or new growth too high up (and roots not taking hold in the medium), or a combination of these. Repot the plant, check light, temperature levels, fertilizer dosage,....

Leaves turn yellow, then brown and die:

probably due to fungi, as a result of excessive watering/soggy or decaying potting mix and/or excessive humidity possibly combined with too cool temperatures. Unpot the plant, treat it with a fungicide, cut dead / brown growth and leaves, repot in fresh potting mix. Allow the plant to dry in between waterings.

Growth turns brown:

same as above**.**

No or limited new growth:

may result from nitrogen and/or phosphorous deficiency, or damage / rotting of growth buds (at basis of previous growth).

9.5.2 Flower stem, buds & flowers

Flower stem dries out and does not develop:

probably due to insect damage, plant not absorbing enough water or temperatures out of range (i.e. too low day time, too high night time).

Flower stem turns brown and is watery:

water stagnated in/on the flower stem and provoked flower stem and probably buds) to rot. Remove flower stem, make sure water does not gather and stagnate there.

9.6 Cultural problems - Paphiopedilums

9.6.1 New growth, leaves

New growths are smaller, are stunted, do not grow upright:

the plant is under stress, either because of weakened root system or insufficient light or too extreme temperatures, deficiency in nitrogen, or a combination of these. Repot the plant, check light, temperature levels, fertilizer dosage,....

Leggy plants growing tall:

may indicate plants are not receiving sufficient light (they are stretching themselves to reach the light).

Tips of leaves are brown or spotted:

plant is not absorbing enough water either because of insufficient watering or because of root rot.

Leaves turn yellow, then brown and die:

probably due to fungi, as a result of excessive watering/soggy or decaying potting mix and/or excessive humidity possibly combined with too cool temperatures. Unpot the plant, treat it with a fungicide, cut dead / brown growth and leaves, repot in fresh potting mix. Allow the plant to dry in between watering.

Watery spots on leaves that turn brown or gray or black, sometimes with yellow on the margins:

usually result from bacterial infection. Repot plant, treat plant with a fungicide, keep it on the dry side for a few weeks.

White spots and/or irregular dark patches:

may also result from bacterial infection. Treat as above.

No or limited new growth:

may result from nitrogen and/or phosphorous deficiency, or damage / rotting of growth buds (at basis of previous growth), or setback if the plant was divided and left with only one growth.

Note: If plants or portions of plants are infected by bacteria, ***take immediate action*** as the infection ***can spread rapidly and kill the plant***. Unpot the plant, remove all affected area, treat with a fungicide/bactericide, repot in fresh media.