

Cultivation of Clivia

Clivia Cultivation

Growing *Clivias* is not difficult if you remember a few basic rules relating to potting media, watering, feeding, light and temperature and pests and diseases. Below are a series of articles written by experts on various aspects of Clivia Culture

Growing media

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Six species of *Clivia* are endemic to South Africa, the most commonly grown being *Clivia miniata*, which is now cultivated all around the world. In Europe, it is grown as an indoor pot plant. Their natural habitat is on South-facing slopes, under trees, and often on top of rocks. They are semi-epiphytic plants ("air plants"), living above ground with their roots in leaf litter, deriving their nutrients from the humus, as the leaf litter decomposes. Their large white roots provide an amazing "sponge", giving *Clivias* excellent drought tolerance and nutrient storage. We need to recreate these soil conditions if we are to optimize their growth.

When we cultivate *Clivias* away from their natural environment, several key elements need to be considered:

1. *Clivias* do not like to be planted into soil. Their roots are not designed for living in soil, so they often rot off, leaving only the surface roots alive. They stay alive but flower poorly.
2. *Clivia* roots have a requirement for lots of oxygen around the roots. They hate "wet feet" and waterlogging. Heavy clay soils or heavy growing media are bad for their cultivation.
3. Tall pots drain more than short pots. The height of the pot or the bag determines its drainage capacity, as a factor of the porosity of the medium used.
4. Drainage requires a physical connection from the bottom of the pot onto soil or a capillary mat. If the pot is in the air, then a waterlogged bottom layer (a perched water table) will occur: the medium in the pot will act like a sponge and will not release water out of its bottom layer unless there is capillary action sucking water away from it. So, do not put gravel or polystyrene chunks at the bottom of pots; keep it all one medium. Place *Clivia* pots onto a layer of sand or onto capillary mats. Do not leave them up in the air or on bricks.

5. When we mix media with different particle sizes, the result is called a matrix. What happens is that the small particles fill the pore spaces of the big particles, making a dense mixture. This is the secret of concrete: sand particles fill the spaces between gravel chunks, and the cement then binds them in place. Drainage from pure sand, or pure gravel is high. But when they are mixed in the right ratio, drainage is reduced to very little. So, the principle is that when we mix particles sizes of a growing medium, we reduce oxygen content and drainage, and increase water-holding capacity. If we add sand to a bark medium, we make it heavier, with less oxygen and it drains LESS well. Remember that Clivia are VERY dependent on a high oxygen content in its growing medium.

6. Sand is not all the same. It depends upon what rocks it came from originally: quartzite, granite, dolerite, etc. In general, quartzite sand is the best to use because it has the right chemical and physical properties. What one needs to avoid using is river sand derived from a decomposing rock such as granite. These decomposing sands usually have lots of fine particles that clog up a medium, and when sourced from a river, often carry diseases and nematodes (eelworm). Whatever sand is used in a growing medium, it is important to sieve out all the fine particles (< 0.25 mm), using the coarser particles for growing purposes.

7. Composts and growing media are not all the same. What one is looking for in a perfect growing medium is;

(a) A physically and chemically stable medium (it must not decompose or break down or collapse or compost further)

(b) A good water holding capacity

(c) A good oxygen content, hence good drainage (air-filled porosity).

(d) A good cation exchange capacity (CEC) (how much fertilizer the medium absorbs and then releases to the plants).

Consider the main options in artificial growing media in South Africa:

1. Composted pine bark

This medium is derived from fresh pine bark. A large pile of this is chopped up into large chunks, lime, nitrogen and water are added, and a composting process is started. Every week for 6-12 weeks, the pile is turned upside down to re-oxygenated it, and is re-watered. The pile heats up to 60-70°C each week until composting is completed. In the process, the bark is degraded to a lignin core, the biodegradable cellulose and hemicellulose being decomposed by bacteria and fungi. The result is a black, odourless medium with excellent physical and chemical properties: physically stable, no toxins, good drainage and oxygen content, and a good CEC. It is also completely free of plant diseases and nematodes. An inadequately composted pine

bark will still be a bit reddish, will often smell of pine and will still get hot when in a pile. Plants grow poorly in inadequately composted pine bark media.

A range of different particle sizes (coarseness) is available, which allows one to pick and choose according to the crop. Mature Clivia prefer a coarse medium, often marketed as a coarse potting mix. But a seedling mix is useful for growing out Clivia seed.

2. Vermiculite

This medium is derived from a mica from Phalaborwa, which is heated till the mica "pops" like popcorn. It is widely used in the USA as a growing medium. However, it is problematic as it has a very high pH of around 9.0 which is far too high for most plants, and it decomposes, compacting into a dense, oxygen deprived medium. It is not suitable for use with Clivias.

3. Perlite

This medium is derived from a rock that is heated till it puffs up, like popcorn. It has a very high porosity and drainage, and is excellent for cuttings. Clivias grow well in it but their irrigation and fertilization has to be managed very carefully because the perlite holds very little water or nutrients.

4. Polystyrene balls

These are often added to growing media. However, they add nothing, and may result in a more dense and compact medium with poorer drainage.

5. Coir peat or Coco peat

This is a medium derived from the outer husk of coconuts. It has excellent water holding capacity but it drains poorly. It can be useful to add to a composted pine bark medium to increase water retention, by adding 10-30% by volume to a composted bark medium. Do not use more than 30% or waterlogging problems may occur.

6. Sphagnum peat

Again, it has excellent water retention but poor drainage. It can be useful in mixtures.

7. Mushroom compost

This is not a good growing medium as it is derived from straw, so every bit of it will be decomposed by bacteria and fungi. The effect is that what starts out as a nice fluffy medium soon becomes a heavy, waterlogged medium. Use it to mulch lawns, etc.

8 Chicken litter

This is a poor growing medium as it is based on wood shavings or sawdust, both of which decompose rapidly. It is excellent as a mulch for lawns and gardens.

9. Wood shavings and sawdust

Again, this is a poor option for a growing medium because the particles decompose, breaking down into smaller and smaller particles, getting denser and denser, shutting out all oxygen. Another problem is that, as the bacteria and fungi break down the wood, they “steal” fertilizer from plants, so the plants always look sickly and yellow. It can be used for a single crop of cucumbers or tomatoes grown hydroponically in bags, but should not be used for a perennial crop like Clivia.

10. Bagasse

This is a poor growing medium as it is all cellulose and decomposes constantly. It also has a high salt content. Avoid it as a growing medium for any crop.

11. Topsoil

Soil is a terrible medium to put into a pot. Without earthworms to lighten the soil, and make for aeration and drainage, the soil compacts into a dense, hard “brick”. Adding sand or any other medium does not help: it just makes a dense “concrete”, and the clay in the soil binds it all together like a cement. Topsoil may also carry plant diseases.

12. Garden compost

This is usually derived from leaves and other organic matter. It is excellent to mulch with but does not work well as a basic growing medium.

The worst medium I have seen used was made up of sand, sawdust and topsoil in equal portions. Once it had been in a pot for a month, it made excellent bricks for the building industry! And the Clivia roots died of waterlogging and lack of oxygen.

In South Africa we are fortunate in having an excellent growing media industry based on composted pine bark. If the composting has been conducted properly, and the right grade of medium is chosen, then any potted plants will prosper in composted pine bark. Clivias are best when grown in a large pot or bag, in a coarse potting mix. Alternatively, they can be put on top of the ground and then covered with a coarse potting mix, to simulate their natural conditions. They will survive if planted into soil, but their growth and flowering will be reduced.

Fertilization for Clivias may be in the form of slow release fertilizer granules or dilute liquid fertilizers applied regularly, or both. Their nutrient requirements appear to be

simple, and they respond well to most general fertilizers. Keeping the N: K ratio (nitrogen to potassium) at 1:1 or 1:2 will ensure good flowering. Too much nitrogen on its own results in lots of leaves and little flowering.

If you want to know more about growing media, there is a superb Australian book, which is highly relevant to our conditions: Handreck, K. A. and Black, N.D. (1994) *Growing media for ornamental plants and turf*. University of New South Wales Press, Sydney.

Mark Laing

Growing *Clivia* in a Cold Climate

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Starting Seeds under Lights

I grow *Clivia* in central Indiana (USA). This is in the Midwest, between the Great Lakes to the north and the Ohio River to the south. We have hot summers and cold winters: usual afternoon high temperatures in summer are 86°F (about 30°C) and this past summer our afternoons exceeded 90°F (32°C) on more than thirty days. Our hottest days do not exceed 100°F (about 38°C). In winter, we have several snowfalls each year, and our lowest morning temperatures vary from +6°F (-14°C) to -20°F (-28°C) in our occasional very cold spells. This is U.S. Department of Agriculture cold hardiness zone.

This is not a place where *clivias* are garden plants. They absolutely have to be protected indoors or in a greenhouse over winter. In summer, they do very well outdoors, so long as they are in medium to heavy dappled shade. I grow my mature *clivias* outdoors in summer in our lath house, and in a home greenhouse in winter.

Clivia seeds tend to ripen around Christmas time here in Indiana, just as winter is getting a good start. That means we start them indoors during winter, along with *Nerine* and *Haemanthus* and other later-ripening seeds. While a sunny window would be a possibility, and we do have a couple of home greenhouses, neither works well for us. The sunny windowsill is a shortcut for the cat, and gets too hot on sunny days. The greenhouses are too cool in winter for optimal starting of *Clivia* seeds. The most satisfactory alternative that I have found is to start them indoors under fluorescent lights.

Clivia seeds kept too warm will dry out rather than germinate. Left too cold, they simply wait for nicer temperatures. I have arrived at a working temperature range for *Clivia* germination that seems to be satisfactory: warmer than 65°F but no warmer than 80°F (about 18°C to 26 or 27°C). I keep the young *Clivia* seedlings under the lights and in this temperature range for about six months. Generally, it is summer by then, and they can be moved outdoors into our lath house (probably 60 to 70% shade) for the summer.

I use a mixture of PromixT and sand in a ratio of 2 parts Promix to 1 parts and by volume. PromixT is a peat-based soil-free potting mix containing perlite and vermiculite in addition to the peat. It also shows quite a few small twigs and bits of sticks, and I suspect that there is also some fine charcoal added to it.

I plant all my especially prized seeds, one seed to a pot, in 5½ inch (about 14 cm) square by 5½ inch deep plastic pots. The seed is pressed into the surface of the potting mix, and then the pot is stood in a bucket of water to thoroughly wet all the potting soil clear to the surface. The well-wetted pot is finally set in a tray with other pots of the same lot, and the whole is moved into the light room and placed under the fluorescent lights. Initially the lights may be as low as a few inches above the seeds. As the leaves grow, the lights are raised to stay above the leaves for as long as possible.

If you want to start hundreds or thousands of clivias from seed at one time, this approach needs to be modified. Plant the seeds from a single batch in a larger community container, such as a polystyrene foam box or tray. It should be at least 5 inches deep, and must have plenty of drainage holes in the bottom.

As we have come to grow more and more clivias and bulbs from seed, I have had to have a wall full of shelves installed for the plant lights. They are in my computer room, which stays a bit warmer than the rest of the house all year around. There are four shelves mounted on one wall. Each shelf is 22½ inches deep (about 57 cm) by 9 ft. 10½ inches long (about 3 meters), made of ½ inch plywood and supported by 2-inch x 4-inch lumber. The vertical spacing between shelves is about 22½ inches. The shelves and the walls behind them and at the ends were painted with a matt white enamel latex paint to maximize light efficiency. Each shelf is illuminated by two pairs of two-tube 40-watt fluorescent tubes in shop light fixtures, for a total of eight 40-watt tubes per shelf. Each fixture is hung on chains so their heights can be adjusted as needed. Each shelf offers 18.5 square feet of space, for a total of 74 square feet (about 6.8 sq. meters) under these lights.

Pots are placed in plastic trays on the shelves under the lights. The pots are watered from below, by pouring water into the trays, to avoid washing the seeds loose from the potting medium. Fungus gnats may become a problem, and can be controlled by sprinkling granules of Marathon® on the surface and watering into the soil. The insecticide is watered into the soil by gently watering the pot from above. Marathon® contains 1% imidacloprid as the active agent. It is manufactured by Olympic Horticultural Products for the greenhouse and nursery trade in the USA.

Growing seedlings on

As *Clivia* seedlings in containers grow, they produce more and more roots. When the roots begin to fill the pot or to grow out through the drainage holes in the bottom of the pot, it is time to move the plant into a larger pot. It is critical to the development of the young plant that it be able to produce as many healthy roots as possible.

When the seedling is moved to a larger container, it is also time to change from the sandy, peat, starting medium to a more sharply draining mix. Some growers recommend using orchid potting mixes for growing *Clivia* plants, but I have not tried that yet. I have been using a gritty mix with reasonable success. The composition is roughly PromixT, plus sand, plus granite chick starter grit (about 1/8 in mesh, or 3 mm) in a ratio of 2 parts Promix to 1-part sand to 1-part granite grit by volume. The components are mixed dry in a small concrete mixer until well mixed, or up to an hour. Promix is a commercial soil-less peat-based potting mixture, produced in Canada.

The seedling is removed from its original pot and as much as possible of the original growing medium is shaken gently off the roots. Be careful not to damage the roots. The next step is to re-pot in a slightly larger container. If the seedling had been growing in a 5½-inch (about 14 cm) square pot, you can plant it in a 1-gallon container about 6½ inches (16 or 17 cm) in diameter and 6½ inches deep. Plug the drainage holes loosely with a bit of sphagnum moss, and work the gritty mix carefully in among the roots. At this point, I usually pot the crown of the seedling slightly above the surface of the potting mix in the new pot.

Until the young *Clivia* plants reach a size such that they are capable of blooming, they have no need for a dry or cool rest period in winter. I try to keep the one- and the two-year old plants growing actively through the entire winter. The two-year old's are all in the greenhouse, while some of the one-year old plants are still under lights and the rest in the greenhouse. Keep the greenhouse warm, at about 60°F, at least, and use supplemental lighting if necessary. I have two 400-watt high intensity metal halide lamps hung above one bench in my lean-to greenhouse, but I am not currently using them. Except during the coldest periods (cold inside the greenhouse, that is), water and feed the young plants regularly with a very dilute solution of soluble plant food. I recommend using Peters 20-20-20 soluble with trace elements, at about ¼ to ½ level teaspoonful (about 5 ml) per gallon (about 1.5 to 3 grams in 4 litres.)

When using a continuous feeding regimen such as this, it is necessary to water to excess at each watering, so the accumulating salts are regularly flushed out the bottom of the pot. This is another reason that a quick-draining growing medium is advisable.

My aim is to grow large, healthy seedlings to blooming size in 30 months. I do not always achieve this, but a significant fraction of the seedling plants I have grown so far have bloomed in 30 to 36 months. I do this in a relatively harsh climate, using my own home, a lath house, and a glass and aluminium lean-to home greenhouse. I am not ever going to keep the Belgian *Clivia* growers awake at night with worry!

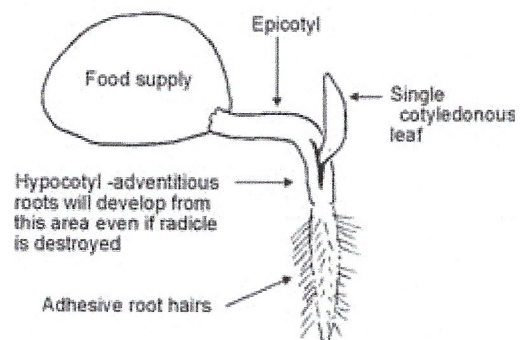
Jim Shields

Nutrition

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You will always find the letters N.K.P. (in South Africa) on the container in which you buy your fertilizer. N (nitrogen) stimulates luxuriant growth, but has to be balanced by K (Potash), otherwise the plant tissues will become soft (thin cell walls) and will have less resistance to disease and drought. Assisted by calcium, potassium plays an important part in the growth zone at the bases of the leaves and peduncles. A deficiency of potassium will result in flowers blooming between leaves. It also affects the size, intensity of colours, quality and life span of flowers. P (phosphorous) plays an important role in the development of a good root system **AND** will determine the number of flowers in the umbel and the number of ovules in the locules.

Nutrition and the quality of your seeds (see accompanying figure) The food supply of your seeds is exendospermous which means that it is a separate food supply for the embryo plant and is stored outside the cotyledon, (seed leaf of the embryo) but the embryo plant is attached to the food supply by the epicotyl and serves as a channel through which the food – after it has been made soluble by enzymes – can reach the developing embryo plant. Just below the longitudinal slit through which the first seed leaf appears, we find the hypocotyl from which the radicle develops. On the radicle you will see a dense growth of adhesive root hairs. In nature this serves to adhere to anything with which it comes into contact (even a radicle from another seed). The radicle tends to grow straight down to anchor the developing embryo plant firmly. For all this growth, a lot of energy (food) is needed. The chlorophyll in the leaves of the plant form simple sugars from CO₂ and H₂O during photosynthesis. Potassium is needed to convert the simple sugars into starch, which is stored in the food supply of the seed. Plant protein is also synthesized from sugars and mineral salts (especially nitrogenous salts) and is likewise stored in the seeds as a good supply for the developing embryo after germination.



It is therefore important to feed your plants well with at least a basic 3.1.5. fertilizer and, if possible, with the necessary trace elements. The Scott's Peters Professional fertilizers (15 .11.29 = N3 : P2 : K6) has the important additional phosphorous and potassium for reasons already explained. I feed my plants at least once a month with a hydroponic mixture just to make sure that the plant medium does not become deficient in trace elements which are equally important (for example: Fe and Mg are both necessary to form chlorophyll).

So, if you feed your plants well during the development of the seeds, they will be larger and germinate and develop faster with an adequate food supply available for development until the first true leaf has developed to a stage where the seedling can manufacture its own food. If the seeds do not have ample food supply, the developing seedlings become runts and the subsequent development will be slow.

Nutrition of seedlings

I recommend spraying seedlings with a plant stimulant like concentrated liquid seaweed extract (Kelpak) which contains auxins such as Gibberellins and Cytokinins or Supranure, which contains indoleacetic acid. (Commence this programme only after all the stored food in the seed has been used up.) Use a hydroponic mixture – mainly for the trace elements – about once a month.

Christo Lötter