

Production technology of orchids

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Orchids are highly valued for their cut flowers in commercial floriculture owing to the wide range of colours, shapes, sizes and fragrance they display, with long vase life being an added advantage. Orchids are monocots belonging to the family orchidaceae. These plants differ from other flowering plants due to their pollen (pollinia) that is formed into a



mass, their stamens and pistils, which are joined together in a structure called a "column", and their seeds, which are very small, do not contain endosperm and have no organized embryo. Orchid flowers consist of the pedicel (the stem of the flower which includes the ovary), the sepals, the petals and 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. Orchids differ from other plants by the way they grow in nature. Most orchids are epiphytes and they grow attached on other plants (usually trees). Some others are semi-terrestrials that is they grow on the ground, on decomposing plant material. A small number of orchids are true terrestrials, meaning they grow in soil like most plants. Some orchids are lithophytes, which grow on rocks. Orchids have two distinct patterns of growth - monopodial and sympodial. Monopodial orchids, such as Phalaenopsis and Vandas, have a single growth, typically an elongated stem that may be fairly short (Phalaenopsis) or reach several feet long like some Vandas, Renantheras or 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.

Factors affecting orchid growth:

Light and temperature: Light and temperature are positively correlated. Orchids grow best in diffused light

but there are certain orchids, which grow well under bright light. Orchids will tolerate levels of light on the higher end of their range provided the plant receives more water, more fertilizer and, if possible, better air movement to keep their leaves a little cooler. If the orchids get too much light and not enough water and fertilizer, they will be stressed. Visible signs of stress are shriveling pseudobulbs and / or leaves, drying buds and prematurely wilting flowers. If the leaves stay green, are crisp and firm, then the light intensity is 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. Very few orchids will tolerate direct sunlight, except maybe for an hour or two after sunrise and an hour or two before sunset. In nature orchids inhabit various habitats, from low land r in forests to mountain slopes, to swampy areas. Therefore some orchids need the warm conditions of a tropical rain forest, others 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.

Water quality and watering: Good quality water is a very important requirement to grow orchids successfully. Acceptable water sources include deionized distilled water, tap water free of salts and rainwater. Watering needs depend on the potting media and the growing conditions. Ideally plants should remain highly moist and should never be dry. The quality of water is extremely important for good culture. In nature plants are drenched by rainwater. Rainwater is slightly acidic with a pH factor of 6.4 to 6.8. Hard water will create hard deposits on the leaves of plants. This may clog the pores on the leaves and reduce transpiration. If the water is hard it may be beneficial to

periodically clean the leaves with distilled water. Water may 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 the new growth. To reduce risks of this happening, water only on sunny days. Watering early in the day will allow any water that got in between leaves or new growth to evaporate before night.

Humidity levels and air movement: Most orchids require 60 % to 80 % humidity. These humidity levels are necessary for the plants to perform their best and bloom. A humidifier will help considerably in maintaining the humidity and health of the plants. Another way of increasing humidity is by setting the plants on trays filled with pebbles or gravel and with water, taking care that the plants are not in contact with the water. Ideally a dozen or more plants should be grouped together as they will create a microclimate with higher levels of humidity. In the orchid houses there should be continuous air circulation.

Propagation of orchids: There are three main methods of propagating orchid plants: macrovegetatively, *i.e.* by dividing large plants, removing offsets and plantlets; microvegetatively by meristem or mericlinal culture, *i.e.* by growing and dividing small growing tissues in culture media; and by seed.

Vegetative propagation by division: Many species of epiphytic orchids, especially *Dendrobium* and *Epidendrum*, produce small plantlets (Keikis Hawaiian word for “babies”) on their stems and these can be removed and potted up. Other pseudo bulbous species, such as some Pleiones, often produce small offset bulbs, which after perhaps several years of careful culture will reach flowering size. Some orchids grow by developing new growth from the base of the plant. After several years they may have 5 to 10 or more growths, which may be subdivided. The usual way of propagating is by dividing large plants. Long stemmed monopodials such as species of *Vanda*, *Renanthera* and *Aerides* are among the most difficult to divide. Only older healthy plants that have developed aerial roots 20cm or more from their bases should be propagated by cutting them into pieces below each root.

Propagation by seed: Growing orchids from seed are a delicate and complex activity.

In vitro seed culture: Orchids seeds are extremely small and usually undifferentiated. They are produced in large numbers. Each seed contains an undifferentiated embryo composed of 80-100 cells without any functional endosperm. At IIHR, a technique was developed for viability testing of orchid seeds with the help of tetrazolium chloride (2,3,5 Triphenyl 1-2-4 tetrazolium chloride) and

malachite green. The chemical, tetrazolium chloride is imbibed by the seeds as colourless solution and is reduced by the enzymes present in the viable embryo to a red coloured substance formazan. In the absence of any enzyme the dead embryo will remain uncoloured composition of nutrient media. Different media are used in orchid seed culture. Some media like Knudson C, Vacin and Went are broad spectrum, while media like Burgeff are exclusively for *Paphiopedilum* seeds.

Green pod culture or embryo culture: In green pod culture process the seed capsule is removed from the plant after fertilization. The surface of the capsule is cleaned with sterilizing agent and flamed after dipping in alcohol; the seed capsule is opened with a sharp blade and seeds sown directly into medium under aseptic conditions. The embryo on the nutrient media start turning green after 10-20 days depending upon genera. It is recommended to prick out the seedlings 2-3 times *in vitro* conditions before they are big enough to be transplanted. The medium should be changed with each pricking, reducing the level of sucrose when seedlings are big enough (3-4 months), they can be taken out.

Tissue culture: Vegetative propagation method, meristem culture, has gained importance. However, meristem propagation has only been achieved, to a commercially acceptable standard, in *Cattleya*, *Cymbidium*, *Calanthe*, *Dendrobium*, *Miltonia*, *Odontoglossum*, *Oncidium*, *Zygopetalum* and hybrids. Plants produced by this method, when young are known as mericlones. Here the meristems are transferred to a culture medium where they can be subdivided and an unlimited number of new plants raised.

Apical meristem of a young shoot is the most commonly used explant both in monopodial and sympodial orchids; terminal and axillary buds from shoot tip containing meristem have also been used in many cases. The other parts of the plant used are inflorescence segments, root tip, lateral buds and leaf. Orchids can easily proliferate on very simple medium like Knudson C or the more stable Vacin and Went medium. Several adjuncts like coconut water (150 mg/l), banana pulp (100 g/l) and peptone (1-2 g/l) are commonly used.

Containers for growing orchids: The most common containers / supports for growing orchids are:

Plastic pots : Most commercial growers use plastic pots because they are inexpensive, they are lighter and they are easier to store; hold water for a longer period than other pots / containers, mineral salts (from water and fertilizer) will not adhere to them, and roots will not get attached to them. Plastic pots are excellent containers for growing orchids. Pots with a number of drainage holes have to be

used (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 teak wood.

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 look.

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

Potting materials: Understanding the properties of potting materials will be useful in selecting the potting material that best meets the growth requirements. The potting materials for orchids must:

- Hold the plant in place, hold enough moisture (water) for the needs of this particular orchid,
- provide an environment that will enhance the development of roots (aeration).

Most potting materials for orchids do not provide any nutrients. The nutrients are added in the water we use and that's how they are made available to the plants either through foliar sprays or by soil application near the root zone. There are many potting material for orchids, such as brick pieces, tiles, cocopeat, sphagnum moss, tree fern, osmunda fiber, coconut husk, coconut fiber, lava rock, charcoal, pieces of cork, peat moss and rockwool.

Potting orchids:

Potting monopodial orchids: The plastic pot size should be just large enough to accommodate the roots. If a clay pot is used, a pot that's just one size larger than the plastic pot, allowing for about 1" of space around the roots. The plant is centered and held so that the junction of roots and

lower leaves is in line with the top of the pot, and potting mixture is added. While holding the plant from the base, the potting mixture is firmed to the inside rim of the pot. When done the base of the plant should be just a little higher than the media so that leaves do not touch the media and the top of the roots are just a little bit exposed. If necessary the plant is staked so that it does not topple.

Potting sympodial orchids: The procedure for potting these is instead of centering the plant the older portion of the plant should be as close to one edge of the pot, leaving room on the opposite side of the pot for the new growth(s). When done the base of the plant or the rhizome should be just a little higher than the potting media so that leaves do not touch the media and the top of the roots are just a little bit exposed.



Repotting and care after

repotting: Repotting is done after 2-3 years if the plants have over grown the pots. The old roots and leaves can be pruned. Plants can be divided with a minimum of 3-4 shoots and a sprouted bud. Repotting is done using a fresh media. Repotting is a shock to plants. So for a few weeks after repotting a plant must be carefully nurtured. For 3 to 4 weeks the newly repotted plants must be placed 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. Water lightly (just enough to get the potting material moist, not enough for the water to run through the drainage holes) until a week after repotting.

Fertilizing orchids: Three basic principles apply to orchid feeding:

- Only well rooted plants should be fed
- The feed is preferable in small but frequent doses
- It should only be applied during the period of maximum active growth.

A fertilizer complex containing NPK in equal proportion (17:17:17) ranging between 0.2 to 1.0% is applied depending on the stage of the crop. During vegetative phase, 30:10:10 combination may be used which may be changed to 10:20:20 during blooming stage. One of the liquid sprays which are generally used is the Ohio WP solution and the composition is:

- Potassium nitrate: 2.63 g
- Ammonium sulphate: 0.44 g

- Magnesium sulphate: 2.04 g
- Monocalcium phosphate: 1.00 g
- Calcium sulphate: 4.86 g
- Iron sulphate: 0.5 g
- Manganese sulphate: 0.25 ml

This spray mixture is made up for 1 gallon (4.5 litres) of water.

Organic manure like cowdung, neem oil cake, poultry manure and so on soaked in water for 4-5 days for fermentation and subsequently diluted 10-15 times may also be used. Coconut water spray also is advocated. Generally the frequency of application is twice a week under tropical conditions. Nutrient availability to plants is affected by pH levels. Most nutrients are available at a pH between 5.5 and 6.5 for orchids.

Yield: The yield is variety specific and on an average, about 5-7 spikes per plant in the second year and 6-8 spikes per plant from the third year onwards can be obtained.

Harvesting: Harvesting should be done in general when most of the flowers on the spike have opened fully with two or three buds. Flowers cut prior to maturity wilt. In *Dendrobium* a spike can be cut at last 1 or 2 buds are yet to open or 20 per cent of flowers are in bud condition. The stalk is cut at the base close to the stem. This operation is generally done in the evenings and the stalks have to be pre-cooled in water before packaging and storage. Immediately after harvest, the lower 0.75cm of the peduncle is cut off, and the flower is inserted into a fresh tube of water containing preservative. Treatment with 8-HQC+5% sucrose improves the flower quality and vase-life of flowers.

Stage of harvest: Stage of harvesting is important, it have influence on the keeping quality of spikes. *Dendrobium* spikes are harvested while two or three buds are still unopened, it adds to the charm of the spikes. This applies to all other orchids, which produce long spikes like *Phalaenopsis*, *Aranda*, *Arachnis*, etc. The number of unopened buds to be retained may be lesser in smaller spikes.

Method of harvest: The spikes that are ready for harvest are cut at the base of the stalk, close to the stem. The cut surface should be smooth and should never be crushed. A sharp knife or secateur can be used for this. When several spikes are cut on the same day using a single knife, there are chances that the diseases are transmitted through the sap. The cut surface may act as substrate for disease causing organisms. Dipping the knife in an antibiotic-fungicide mixture and pasting the mixture on the cut surfaces can help in the prevention of this. Alternatively, flaming the cut surface can also be done. This will help in the sealing of

the wound too.

Post harvest operations: The harvested flowers are immediately dipped in a bucket of water till they are packed. When the spikes are cut from the plant there is chance of entry of air through the cut surface of the spike. If another cut, removing a small portion from the base of the spike, is made under water, entry of air can be prevented. In order to improve the quality of flower spike and increase in the vase life pulsing treatments are given to the cut spikes. In *Dendrobium* hybrids pulsing with sucrose 6% or BA 75 ppm improved vase life of flower spikes significantly. Spikes of *Dendrobium* pulsed with HQ 500 ppm + sucrose 5% for 6 hours recorded the longest period of vase life, decreased the respiration rate, improved bud opening and increased water uptake. Cotton dipped in water and placed around the base of the flower stalk A piece of polythene sheet is then kept in place around the base of the stalk using a rubber band. Small narrow bottles filled with water can also be used. The stalk end is inserted into the bottle and sealed with a cellophane tape around the stalk and the mouth of the bottle.

Packing: The stalks are usually packed in cartons. The size of the carton is determined by the general and the number of spikes to be packed. *Arachnis* require longer cartons as compared to *Vanda* and *Dendrobium*. Generally 50 to 100 spikes are packed in a carton. The cartons are to be provided with sufficient number of holes all around to facilitate good aeration. The prepared spikes are tied in bundles of ten before packing the cartons. It is preferable to provide a lining with newspaper inside the carton. This will not only blot out excess water but also will help to maintain adequate humidity. Among the various types of lining material used *Dendrobium sonia* 17, polythene 50 gauge showed better results in respect of ultimate vase life, bud opening, retention of colour and water uptake. Sufficient packing may be provided between the bundles and carton using shredded paper. This also keeps the flower parts from rubbing and bruising each other. After filling the cartons the top may be covered with a layer of newspaper. The carton is then closed and the joints sealed with adhesive tapes.

Transporting and marketing: The flowers are largely transported by air or sometimes by trains. Proper labeling on the boxes (cartons) will help careful handling of the boxes. Refrigerated transport facilities are always more advantageous to conventional means. In India at present most of the orchid flowers are sold out internally, in cities like Delhi, Kolkata, Mumbai, Chennai, Bangalore, Guwahati and Pune.

Received : 29.10.2012

Revised : 01.10.2013

Accepted : 01.11.2013