ORCHID CULTIVATION FOR FLORICULTURE

PROJECTS

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ACTIVITY OF ORCHIDS:

To provide a support infrastructure to cultivate orchids as a commercial enterprise, support development of breeding programmes and create a facility for exploring orchids as a commercial floriculture business.

The current plans are to have orchid farms as Franchisee growers in concurrence to the existing activities.

It has been proposed to grow a variety of orchid families for cut-flower production and potted orchid plants to cater to the needs of the local and export markets.

BACKGROUND:

Asian Orchids Foundation made its presence in the Orchid Floriculture activity during last 15 years. Having had a background into the cultivation and growing of Orchids for the past few years as a specialist collector of Orchid species and Hybrids, we went into share our expertise in the most beautiful flower crop as a technology provider.

We got associated with growers from Singapore, Malaysia, Thailand and Indonesia in particular and also with cultivators from other parts of the world.
We went in association with Genting Orchids Co., Malaysia a leading cultivator and exporter of exotic Orchids to set up farms in India.

Focus on high quality Orchids with optimum vase life has always been our ambition. Oncidiums, Dendrobiums, Arandas, Mokaras, Ascocendas, and Arantheras are some of the popular varieties produced and outsourced for commercial cultivation.

INFORMATION INPUTS:
Having created a large database of registered Hybrids running in the commercial Orchid cutflower market we have established a website known as Orchids asia and a bimonthly literature for the growers from the belt to disseminate information.
We are bringing this as a bimonthly Publication as well as several monographs on Orchids are under print. We have also a vanilla industry portal, which is on the net catering to the vanilla growers around the world.
We have already established three projects in India and are in the process of setting up few more in the coming months.

FARM MANAGEMENT and CONSULTING:
We provide the best in terms of total management including best cropping patterns suitable to the environmental characteristics of the location, appropriate fertigation schedules, Mitigation and Insecticide management to produce disease free plants giving better flower production.

We also impart the necessary growing expertise to the farm hands through training in existing farms and also through rigorous hands on experience in flower cultivation.

We jointly undertake to provide the preliminary feasibility to start a successful Orchid enterprise.

We also help in the site selection, creating the basic infrastructure to put up the green houses, provide appropriate energy efficient systems and proper Irrigation know-how to make a farm with least amount of expense.

Our financial appraisal on all aspects of setting up the farm help in mobilizing the required funds for the project in the fastest track record for sanction from the financial institutions.

We provide the necessary infrastructure and our strategic presence in the Flower markets around the world to provide our grower customers and franchise farmers the convenience of assured returns by the qualitative Buy back arrangement.

ORCHIDS ASIA.COM - A major portal on asian orchids.


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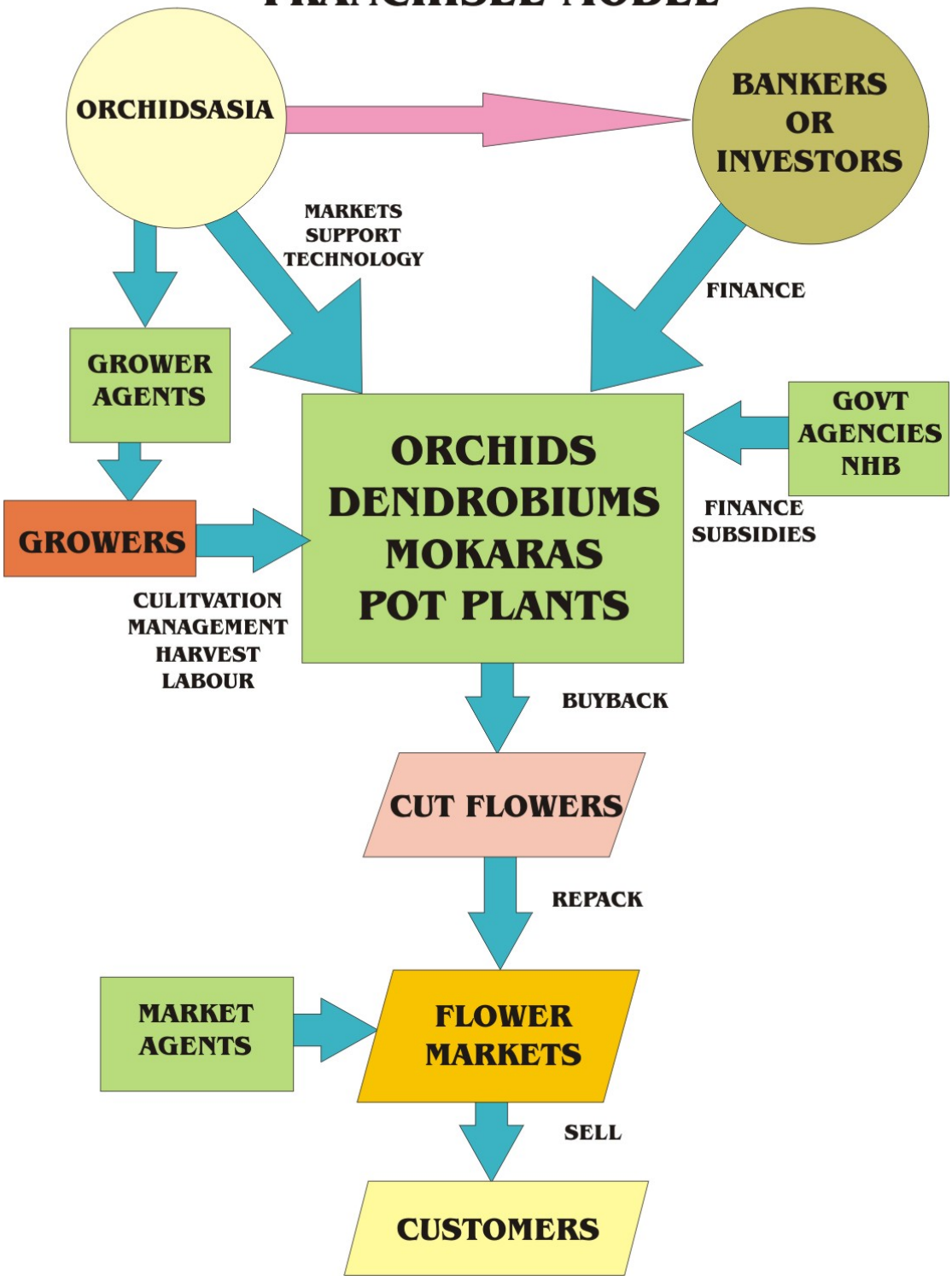
ORCHID CULTIVATION BUSINESS FRANCHISEE MODEL



ORCHIDS AS A COMMERCIAL CROP

INTRODUCTION

The orchids are flowers of exquisite beauty and variety of patterns belong to one of the largest family, the Orchidaceae. There are about 30,000 species in nearly 750 genera and more than 77,400 natural and man - made hybrids . The orchids are worldwide in distribution with greater concentration in tropical and subtropical regions of high humidity. In India, they form 9% of our flora; nearly 1,300 species in 140 genera dwell in the country with Himalayas as their main habitat and others scattered in eastern and Western Ghats. In general, the terrestrial orchids are more common in Northwestern India and the epiphytic ones in North-Eastern India; the orchids in Western Ghats are usually with small flowers.

The orchids are highly heterozygous and their vegetative propagation through division is rather slow. They germinate very poorly in nature, because they require an appropriate fungus for the purpose. It is due to the difficulty in natural propagation that some of the indigenous species are becoming extinct and their export, from natural population, has been restricted for export by the Government.

The orchids represent the first floricultural crop successfully mass propagated through Tissue Culture technique and the commercial application of micropropagation is being increasingly realised in this group of great ornamentals.
Half of more than 200 commercial Tissue Culture laboratories, throughout the world, micropropagate orchids and have helped in revolutionise the orchid industry in several countries.

CURRENT - POTENTIALS
The orchids are marketed both as potted plants and as cut-flowers. In the past few years, the orchid trade has increased both in volume and value throughout the world. Presently, Taiwan are the largest producer of orchids for pot-plants under greenhouses; the orchids are grown in an area of about 196 ha,over 125 million orchids were exported from the country.

Many developing countries including Malaysia, Thailand, Singapore, Taiwan , Phillipines, Sri Lanka, and Indonesia have established their own orchid Industries. A large export market is available if the products are right and marketed properly. At present India's share in US $ 6000 million world floriculture trade is a dismal $ 3 million foliage and flowering potted plants, and the rest on cut-flowers and other items.

Bottlenecks in India

Majority of the cultivated orchids are native of tropical climates and are found in abundance in India in the state of Assam, Meghalaya, West Bengal, Karnataka and Kerala.
Almost all these states are also viable areas for commercial cultivation of Orchids.

Despite the fact that India has diversified climate, low cost of labour, and progressive farming technology, the orchid industry is not even in an infant stage both in terms of micropropagation and commercial cultivation. The total export does not cross more than Rs. 250 LACS and that too is through the sale of orchid plants.
This has been mainly due to non-availability of suitable planting material for large scale cultivation, lack of technology for commercial multiplication, lack of post-harvest handling technology for cut-flower export, and lack of incentives, appropriate policies for exporters, and commercial approach in cultivation.

Fortunately, the country has all the potentials for development of a successful orchid industry on scientific basis; it has varied and suitable climate and almost all the important commercial varieties of orchids including those of *Cattleya, Cymbidium, Dendrobium, Oncidiums Phalaenopsis, Paphiopedilum*, and *Vandaceous* can be grown for cut-flower production.

Sikkim, Arunachal Pradesh, and Himachal Pradesh are orchid rich areas in the country. In South India, Kerala and Tamilnadu with high humidity and low temperature accompanied by good rainfall, have a congenial climate for commercial orchid cultivation. There is also a tremendous potential for growing these plants, on commercial scale, along the coastal region in Maharashtra, Andhra Pradesh, Tamil Nadu, and Karnataka, in the Western Ghats.

At present, the internal demand for cut-flower and ornamental plants in mainly met through production from farms in the south. However, with the development of efficient low cost greenhouses and post harvest technology, the ornamental plants for cut-flowers can be grown in a number of other parts of India as well.

SOME ORCHIDS FOR CULTIVATION IN INDIA

DENDROBIUM

VARIETY	COLOR
1. New SONIA Bom	DARK PURPLE
2. SONIA 17M	DARK PURPLE
3. SONIA RED	PURPLE
4. GENTING CASINO	PURPLE
5. BURANA JADE	GREEN
6. SAKURA PINK	LIGHT PINK
7. BOONCHOO GOLD	YELLOW RED LIP
8. GENTING SUPREME	BLUE
9. AHULANI HINOJOSA	BROWNISH ORANGE
10. KYOMI BEAUTY	DARK PINK
11. BURANA GREEN	GREEN

ONCIDIUM

1. ONC GOWER RAMSEY	YELLOW
2. ONC. Taka	YELLOW
3. ONC . SHARON BABY	PINK WITH SPOTS

MOKARA

1. MK CHARK KUAN	PINK, ORANGE, RED
2. MK NEW NORA BLUE	BLUE

ARANDA

1. ISKANDER	YELLOW
2. CHRISTINE ALBA	WHITE/RED SPOT

OTHERS

Arachnis Maggie Oei	
Aranthera James Storei	
Aranthera Anne Black	
KGW CHRISTIE LOW	RED
KGW SANDY GOLD	ORANGE, RED SPOTS
VANDA MARLIE DOLERA	PURPLE

In Singapore and Thailand , the orchids are grown in the shadehouse, in an area totaling more than 275 ha. In Thailand, the orchid cut-flower Industry has been the major foreign-exchange earner; it accounted for US $30 millions in 2000,s and nearly $40 millions in 2004.

The increase in flower production in Netherlands, Central America, Mexico, Israel has been very significant in the past decade. Currently, however, there is a definite leveling off in these countries.

Even the traditional producers such as U.S.A., Germany, France, U.K. etc., have now become the largest importers of these products.

CULTIVATION OF ORCHIDS

Types.

Orchids can be divide into two groups - monopodial or sympodial depending upon their habit of growth. Monopodial orchids such as Phalaenopsis, Renanthera and Vanda have a main stem which countrieas to grow year after as Cattleya, Cymbidium have a main Stem which terminates growth at the end of each season. A new shoot then grows from the base forming it's own bulbous stem called pseudo-bulb which eventually flowers.

The pseudo-bulb or thickened stem are very useful devices for the storage of food and water and function like bulbs.

In addition to the epiphytic orchids, there are also grounds orchids or terrestrial orchids, which grow like ordinary plants with their roots in soil. Most of the temperate zone orchids are terrestrial and tropical orchids are epiphytes.

Cultivation Of Dendrobiums: Dendrobiums are easy to grow cutflower products offering a good return for the growers as they can be highly floriferous and easily flowering. They are grown in 50% shade houses in Benches and in pots using cocofiber. They usually produce around 10 – 12 flower stems ranging from 35 to 60 cms and having a good vase life.

Cultivation Of Mokaras, Arandas, Arantheras, Vandas: These are mostly sun loving orchids generally needing a 30 % shade cultivation and grown in direct media from the ground up or in benches or in wooden pots. They are comparatively heavy feeders compared to Dendrobiums and can produce around 4-6 flower spikes per annum and having a good shelf life but shorter stems.

Cultivation Of Oncidiums: This family is grown similar to Dendrobiums and the difference here is that they like slightly colder regimes than dendrobiums as the psudobulbs store more food in colder region. They are highly floriferous and can produce long flower sprays of about 1 m in length but smaller flowers.

Orchid House.

Orchids in nature grow protected from the tropical sun by the shades of trees. Under controlled condition the orchids can be grown in specially designed orchidaria or orchid houses, running North and South and made from materials like split bamboo, glass, fibreglass, etc. A central tank filled with water helps in increasing humidity. However, it must be clear that all types of orchids cannot be grown under one roof. While tropical orchid enjoy humid, warm atmosphere and burst into activity during rainy season, temperate orchid should be growing in cool houses. Orchids dislike sudden change in temperature, however a difference of $10^{O}C$ - $20^{O}C$ between day and night temperature is beneficial. The best suitable range is $18^{O}C$ to $30^{O}C$, proper ventilation is must to provide fresh air and also helps in reducing the temperature.

There are also orchids, which can be grown in open sun. Various terete leaves species of Vanda, Aranda, Arachnis, Renanthera etc. can be grown in open trenches filled with bark pieces, charcoal or coconut husk or wood shavings as is done in Ceylon, Singapore and Thailand.

Light.

Indirect sunlight is idle for orchids. Seedlings requires less than adult plants. Very poor light tends to produce weak plants and retards flowering. A plant which has been grown in shades should be gradually be shifted to sunlight.

The optimum requirement of light varies between species to species. Cypripedium and Phalaenopsis require only 200-300 foot candles. Whereas genera like Vanda and Aranda thrive best under 800 foot-candles. Majority of orchids are day neutral and are not influenced by day length. But in Cattleya both short-day and long-day plants are met with.

Humidity / Watering.

Humid warm atmosphere is most essential for the growth of most of the tropical orchids, which do not have well established root system. It is a good idea to have a water tank or pool in the center of the orchidaria to maintain humidity, which should not be less than 30% at night and 80% during day time, The plants should be watered 2-3 times a day and should not be allowed to dry up during hot climate. Plants in active growth require more water. Similarly plants in baskets require more water than those in pots. Care should be taken to water the plants with a fine spray by using standard nozzles and not to hit the plants with powerful jets of water.

Plants which are freshly potted should be watered very sparingly till the new roots appear and watering should be gradually increased.

Pots / Container,Growing Media.

Orchids should be potted in small container/spots according to the size of the plants. As a thumb rule, orchids should be under potted to get more flowers. Any kind of pot/container which can hold medium and provide aeration is suitable. Most of the people prefer ceramic pots which retain moisture longer than plastic pots. Vandaceous and Sarcaenthene orchids can be grown in teak-wood baskets.

Orchid plants should not be disturbed frequently and repotting done only when absolutely necessary. Orchids like Cymbidium, react favourably when repotted after 2-3 years whereas Vandeceous orchids and Paphiopedilum should not be disturbed unless very necessary.

Terrestrial orchids, like Spathoglottis, Phaius and Calanthe, should be grown in 20-25 cm pots with 1:1:1 mixture of leaf mould, FYM and wood mix. For Paphiopedilum A mixture of 2 parts leaf mould, 2 parts wood mix and 1 part each of charcoal is recommended.

Chunks of hardwood charcoal or wood media treated alone as potting substance were superior then eleven other potting media. Tree fern fibre also performed better than the other media while coconut husk as a growing media had wonderful effects on growth and flowering of orchid plants. Some latest media tried for growing orchids are gravel jelly, fir bark, tree fern fibre and polyurethene foam.

Manuring.

In nature, orchids obtain their supply of inorganic nutrients like calcium, magnesium, iron, potassium, nitrogen and traces of manganese, boron, copper, zinc etc. from the tree on which they are growing and also from atmosphere and decaying vegetables and dropping of birds. However under controlled conditions they have to be supplied with all these major and minor nutrients.
Taking into consideration the special need of different orchids, a large number of fertilizer mixtures, both solid and liquid, are available in market. Liquid fertilizers are much more quickly absorbed and can be applied more frequently. As the orchids are slow growing, slow release fertilizers can be used to get very good result. Usage of fertilizers should also depend on stage of growth. During vegetative growth, large quantities of nitrogen are required while during flowering, nitrogen should be reduced and amount of phosphate increased.

Diseases and Pests.

Like all other plants orchids are also pone to a number of diseases caused by fungi, virus, bacteria, insects and pests. The most common diseases in each group are:

FUNGAL AND BACTERIAL DISEASES

Leaf spot - caused by Colletotrichum and Gleosporium
Leaf blight - caused by Pythium
Collar blotch - caused by Penicilium thomii
Collar rot - caused by Sclerotium
Orchid wilt - caused by Sclerotium rolfsli

Various fungicides like Captan, Dithane, Agrosan and Ceresan are very effective against these diseases.

VIRUS DISEASES

More than 32 diseases are known to occur on orchids. In some cases the same virus has been known to produce more than one diseases in different species, the most common are Cymbidium mosaic virus.

As control measures all infected plants should be isolated to prevent spreading of the disease.

The most commonly reported insects pests on orchids are thrips, aphids, spidermite, soft scale, mealy bugs, orchid weevil, snail and

slugs. These insects pests harm the plants in many ways. They feed on tender young shoot, suck the sap and damage the young bud and shoots and also act as the carrier of different diseases.

Fortunately all these can be controlled by effective insecticides like Parathion, Malathion, BHC, Aldrin, Dieldrin, etc. Metaldehyde has proved to be very effective in killing slugs and snails.

PROPAGATION OF ORCHIDS

Orchids like other Horticultural crops, may be propagated either sexually or asexually. Since most of the commercial orchids are highly heterozygous they are not raised through seed and are propagated through vegetative means to get true-to-type plants. Conventional methods like cuttings, division of shoots or Keikis, are followed along with mericloning through tissue-culture techniques.

VEGETATIVE PROPAGATION.

Cuttings.

Orchids like Aerides, Arachnis, Epidendrum, Renanthera, Phalaenopsis, Vanda and Dendrobium can be propagated by cutting. Orchids cutting are usually more bigger and should possess one or more roots. Cutting are usually potted in propagation beds or directly in pots after treating the cut ends with fungicides to prevent rotting.

Cutting of genera, like Aerides, Arachnis, Vanda etc., are very hardy and can be directly potted in pots, whereas those of dendrobium and Phalaenopsis need special care to root and should be potted in propagation beds.

The propagation of orchids through cuttings is getting popular again and some of the nurserymen like to propagate their orchids through cuttings to get uniform plants. The percentage of variation through this method is almost nil as compared to in vitro propagation through tissue culture. Further some orchids like Anaectochilus respond more to vegetative propagation through cutting than any other method.

Most of the sympodial orchids, like Coelogyne, Cattleya, Dendrobium and Cymbidium, are propogated through this method. The method involved consists of dividing large clumps into smaller units. However care should be taken not to divide the plants unless there are 8-10 pseudo-bulbs. Dendrobiums which are very fast growing can be divide every year.

Off-shoots and Keikis.

In some monopodial orchids like Ascocenda and Phalaenopsis, Keikis or off-shoots Emerge frequently on the main stem.. This usually happens when the apex has lost its effectiveness in suppressing axillary buds. In most of the commercial orchid nurseries topping of the stem is commonly practised to induce Keikis formation.

Induction of Keikis can also be induced through the use of cytokinins which forced the dormant bud to develop into keikis.

Aerial shoots.

Most of the dendrobiums produce aerial shoots or bulbs on old back bulbs devoid of leaves. They usually arise on the upper part of the back bulbs and grow out slowly. These aerial shoots take 90-120 days to develop roots. At this stage, they are detached along with the portion of back bulb and potted as independent plant.

In genera like Goodyera, Rhizomes gives off special lateral branches which turn up and produce aerial shoots. When they are properly rooted they get detached from the mother plant and establish separately.

Other methods.

In few genera, like Peristylus and Nervillia, the roots are produced from above the tubers, each of which ends in tubercle. These small tubers produce new plants the year after.

Vanda and other monopodial orchids can also be multiplied by air-layering or morcotage. A cut is given through the stem 20 to 30 cm below the apex and most sphagnum moss is wrapped around the cut portion. The rooting media is kept moist and once the root is formed, the layer is removed from the mother plant and potted in small-sized pots.

DEVELOPMENT OF ORCHID INDUSTRY IN INDIA

The Indian orchid industry is has grown in the past few years. There are a few exporters from all over India. There are also now around 8 commercial cut flower orchid farms situated in Tamil Nadu, Kerala, Karnataka and Maharashtra and one farm in Assam. The value of the export can be increased considerably if the export is enhanced and well organised. Due to various climatic condition, which are available in India based on elevation and rainfall patterns, it is not difficult to grow different orchid genera at different centres for commercialization.

The vital secret behind the commercialization of orchid lies with the orchid enthusiasts and hobbyists who are the ultimate buyers of the plant, and who always go for novelty, uniqueness and rarity. A species with moderate type of flower which is abundant in one region can be a piece of pride and create an aura of fascination in a different region where the species is introduced for the first time. There can be two broad categories for commercialization.

Sale of plant material.

Novelty, uniqueness and rarity are the basic requisites for the sale of plants.

All available orchid hybrids which have the above requisites should be collected, cultivated and properly identified. It has been observed that the selling rates of Indian hybrids are not fixed ..

The present prices are arbitrary and result in the loss of valuable foreign exchange. A proper system of customer information system is not in place leading to chaos and confusion. If a grower tries to approach the problem properly he is sure to gain an appreciable market..

There are also good rental opportunity for corporates and Tourism / Hotel Industries for Orchids as they are the most unique plants which can stay in low light interior levels.

Export of cut flowers.

The cut flower industry in orchids is well established and the cut flower produced in tropical and sub-tropical regions are regularly exported to European and American countries. Singapore and Thailand export orchids to Europe, USA and Japan regularly.

In India some of the genera, like Cymbidium, Paphiopedilum, Vanda, Arachnis and Dendrobium, can be grown on a large scale for cut flower production. Only those species should be selected for commercial flower production which flower in winter and spring as it is only during those months that India can capture the European and American markets. The best time of the year to export flowers to temperate regions is from December to May. The main pre-requisites of developing a successful orchid cut flower industry are

(1) Attractiveness and long shelf life of flower.

(2) High productivity and right season of bloom and

(3) Easy in packing and transporting.

Although the major aim for the development of orchid industry in India should be export oriented, the domestic market should not be neglected, as the demand for orchid cut flower is likely to increase. Further action needs to be taken on the following lines.

Introduction of exotic species and hybrids.

Instead of depending solely on the foreign hybrids it is recommended that a large number of modern hybrids which are used for cut flower production should be bred.

The procedure for the introduction of plants material should be simplified and the import of hybrids can be easily done with a good study.

"Feeding & Watering Orchids and the Function of Nutrients in Plant Growth"

Plant growth requires the input of both energy and matter

Energy comes from two forms:
Matter comes in several forms:
Light energy is utilized in the well-known process photosynthesis, the building of chemical compounds through the interaction of light with small molecules.
Heat drives transpiration, which results in the upward movement of water and minerals within the plant. As water evaporates from the leaves it is replaced from the roots. Without light and transpiration, plants cannot grow.
Invariably, the question is asked, "How much of each of these variables is correct"?
Most growers agree that light levels, around 1800 - 2200 foot-candles produces good growth for *orchids*. The choice of light levels will depend on how well the temperature of the greenhouse can be controlled during the hot summer months.
Day temperatures around 21-26°C (70°F-80°F) grow excellent plants. While night temperatures around 10-14°C (50°F - 55°F) produce the best growth. Robert Dugger points out, good results can be obtained during the summer months if a sufficient temperature drop occurs from day to night, even if the optimum temperature cannot be achieved.
Much of the chemical activity of a plant occurs at night. It is important that the temperature and humidity are correct in the evening. Some orchids evolved in the cool, buoyant neo-tropics. Their physiology, roots, vascular system and leaf structure cannot replace water lost through transpiration if the surrounding atmosphere is not correct.
The primary purpose of this article is to discuss the feeding of orchids.
Next to water, fertilizer is the source for most of the building blocks for a plant (an exception is carbon, which is derived from CO2 through respiration). Fertiliser is typically purchased as a powder, in a bag or in liquid form. This nutrient solution, composed of both fertiliser and water, has mineral concentrations, which are the sum of the fertiliser plus the minerals already dissolved in your water. Some of us have water low in minerals while others have water with moderate or high amounts of minerals dissolved in it. Unless you know the quality of the water you start with, you cannot know what you are feeding your orchids. This is one reason why it is hard to compare grower "A" to grower "B".

Fertiliser

N - P - K

Fertilisers are labeled with the quantity of macro elements, nitrogen, phosphorus and potassium sold in the package. Labelling provides the N-P-K values for nitrogen, phosphorus and potassium.

Why "K" for potassium? The K comes form the German word for potassium, kalium. K is the internationally accepted symbol for the element potassium. To confuse matters, the N in N-P-K is the percentage of nitrogen that can occur in several forms such as nitrate, ammoniacal nitrogen and urea. P is the percentage of phosphorus as expressed by the molecule P2O5 even when the phosphorus source is not P2O5 and similarly K is the potassium (kalium)

percentage as expressed by the molecule K2O. In addition to N-P-K, fertiliser contains micronutrients, nutrients needed by plants in very small quantities. Micronutrients already exist in our water supplies and as impurities in the constituents of fertiliser, even when they are not listed. A confusing aspect of nomenclature is ratio. A 30-10-10 fertiliser has the same ratio as 15-5-5 fertiliser; however, the former is twice as strong per unit of weight.

Feed Ratio

Plants are about 90% water and 10% solids. The ratio of nitrogen, phosphorus and potassium in plant tissue once the water is removed is about 3 - 4.5% N, 0.3 - 0.6% P and 3 - 4.5% K (1 - 2% Ca and 0.2 - 0.5% Mg). So, what do plants need to be supplied for growth? Plants are adaptable and are not damaged by moderate amounts of N, P or K, regardless of the ratio. Experimentally, a ratio was determined some decades ago which supported excellent growth in orchids. This ratio is 3 - 1 - 2 ratio. My own experience shows this ratio works well. I have reviewed the fertilising schedules of two, superb commercial *orchids* nurseries. One uses a ratio of 4-1-2, the other 4-1-4. In other words, nitrogen is added in the largest percentage, with phosphorus significantly lower than nitrogen and potassium somewhere in between.

My Recommendations:

Go for a feed close to the 3 - 1 - 2 ratio, long accepted as ideal. Ironically, articles on orchid culture often recommend a "balanced" fertiliser such as 20 - 20 - 20. fertiliser companies make 20-20-20? High phosphorus levels are intended to compensate for phosphorus lost in reactions with constituents in some soils. These reactions do not occur with soil-less orchid mixes; therefore, high P ratios are not needed. The ratio of a fertiliser does not express its strength. One can add a small or large amount of fertiliser of any given ratio, thus varying strength. What strength should we feed? Orchids are relatively light feeders compared to other plants. Some orchids, like members of the genus *Disa*, are exceptionally sensitive to feed and are injured at modest feed strengths. I have found *Orchids* particularly sensitive to moderate feed strengths. How strong you make your feed is partly dependent on the quantity of salts (the word "salts" used here means dissolved compounds, not sodium chloride or table salt) you have in your water before you add fertiliser. If your water is relatively pure you can add more fertiliser than if your water begin high in salts.

The important factor is not to exceed a certain total value of dissolved salts. The concentration of salts in a nutrient solution, held by the mix, (more correctly "substrate") effects a parameter known as the "salt index" or osmolarity. As the osmolarity of the substrate solution increases less water transport occurs from the root. Typically, orchids are watered and allowed to partially dry, between each watering, thus a further increase in osmolarity occurs as water evaporates from the substrate. With excessive substrate osmolarity a plants water loss from transpiration will exceed the water replaced by the roots. This results in several problems. A common problems is leaf tip die-back, a condition where the leaf tips dies because of lack of water. Warm days, a poor root system and excessive drying out of the substrate in the presence of high feed rates will exasperate leaf tip die-back.

What is a good, safe level for nutrient solutions?

In simple terms, about half the application rate found on most fertiliser bags is relatively foolproof. Is there a better way to express fertiliser strength? On the inside of most bulk fertiliser bags are the calculations for achieving a certain number of parts-per-million

(ppm) of nitrogen. This is usually in pounds of feed per 100 gallons of water. If you can do the arithmetic and extrapolate the rate for your feed program:
I recommend feeding at about 80 ppm nitrogen.
Growers with relatively pure, low conductivity water can feed plants higher concentrations of the nutrients plants need than growers who start with water already high in salts. Supplying the N-P-K levels to a plant at the optimum ratio at sufficient concentration provides the correct amount of feed for good growth. Add the correct amounts of energy in the form of light and heat and one is growing "spot-on". The grower who does this for the most months out of the year ends up the winner.

Conductivity meters

There is an even more sophisticated method of determining feed strength. Pure, distilled water has low conductivity and virtually all compounds relating to feed programmes, dissolved in water, significantly increase the conductivity of the solution (urea is an exception). Until recently, the conductivity of a solution was expressed in the conductivity unit "mhos". The mho is ohm spelled backwards and mathematically the reciprocal of the resistance unit, the ohm, I.e., I/ohm's=mho's. One could use either the ohm or the mho to measure conductivity in the solutions we work with for plant culture; however, the conductivity numbers are easier to interpret than resistivity values.
The tradition in horticulture is to refer to the conductivity of a solution as its "EC" (electrical or earth conductivity). The EC for fertiliser feed stocks will vary depending on each specific crop need. The EC for most horticulture crops falls within a range of 0 -2000 Siemens (in "old" units, an EC of 0-2 or 0-2 millimhos). It is most productive to run feed levels high enough for good growth. It is important to avoid excessively high feed concentrations which will result in problems such as leaf tip die-back and root damage

What is a good EC value?
I recommend an EC of 800 Siemens in the summer months and about two thirds this rate in the winter. Growers with relatively pure, low conductivity water can feed plants higher concentrations of the nutrients plants need than growers who start with water already high in the salts.
Supplying the N-P-K levels to a plant at the optimum ratio at sufficient concentration provides the correct amount of feed for good growth. Add the correct amounts of energy in the form of light and heat and one is growing "spot on". The grower who does this for the most months of the year ends up the winner.

Urea

Urea is a cheap form of nitrogen often used in fertiliser. Solutions of urea in water have low conductivity. Urea in its better, low biuret grades makes a good nitrogen source for plants grown at temperatures that are above 16°C (60°F). It is not a good source of nitrogen for cool growing crops, particularly during the winter months because bacteria populations, needed for nitrifying urea, are in low population. Urea requires bacterial action before its nitrogen is available to plants.

The function of Macro- and Micronutrients in Plant Growth.

There are sixteen elements which are essential for higher plants (Orchids) to complete their live cycle. Nine elements - carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur - are described as macronutrients because large quantities are required to control the process within plant cells and form the compounds necessary for plant growth e.g. sugars, starch, cellulose, lignin, fats, amino acids, plant hormones etc.
The first three macronutrients, carbon, hydrogen and oxygen is available to plants in 2 compounds i.e. carbon dioxide and water, and is present in most of the hundreds of compounds formed in plants.
Seven elements - iron, zinc, copper, manganese, boron, molybdenum and chlorine - are described as micronutrients (or trace elements) because they are needed in very small concentrations for plant growth. Their function is to assist in the many complex reactions which result in the formation of the previously mentioned substances.
The essential elements are generally supplied to orchids as solutions of compounds such that the living plant tissue contains the nutrient at levels and proportions sufficient to maintain satisfactory growth and development. It is interesting to note that some nutrients can be accumulated within a plant even though their concentrations in the plant tissue are higher than those in the external solution around the roots.
The rate of growth of the plant is affected by the concentration of each of the particular elements in the leaf tissue mentioned above. At low concentrations (deficient zone) the growth rate is below maximum but rapidly reaches the optimum rate as the concentration of the element in the leaf tissue increases. In the deficient zone the plant exhibits characteristic deficiency symptoms because certain plant functions are affected. Any further concentration increase does not change the rate of growth (adequate zone) and excess nutrient becomes stored in the plant.
The nutrient deficiency symptoms which are exhibited by plants include: stunted growth of leaves, stems and roots, deformities of leaves and roots, a yellowing of leaves (chlorosis) and a darkening due to the presence of dead tissue (necrosis). Plants can translocate deficient elements to the new growth areas by transferring elements through the sap-conducting vessels (phloem) from the mature leaves to the new leaves.
Easily translocated elements: N, K, P, Mg, Cl, and sulphur (S).
Intermediate mobility: Zn, Mn, Cu, Mo, (S).
Relatively immobile: B, Fe, Ca.
For example, with a magnesium deficiency, yellowing first appears in the old leaves because magnesium is readily transferred (traslocated) to the growing leaves. With immobile iron and calcium the deficiency symptoms are first observed in the new leaves.

Nitrogen (N)

Nitrogen is generally made available to plants in fertiliser solution as ammonium ions, nitrate ions or urea.
With a nitrogen deficiency the growth of plants is retarded as fewer structural and enzyme-functioning proteins are produced. Under these conditions nitrogen compounds are trans located from the mature leaves to the regions of new growth. This leads to a rapid senescence of older leaves. They first

turn pale green, then yellow overall and finally to a tan colour as they die. The roots of nitrogen-deficient plants are generally more extensive than normal. With excess nitrogen the leaves become darker green, wider and longer but reduced in thickness. This sometimes causes the plant to become droopy. The roots are generally smaller and more bunched than normal.

Phosphorus (P)

Phosphorus is supplied to plants as water-soluble compounds such as calcium dihydrogen-phosphate. These substances regulate the deposition of starch during the development of the above-mentioned storage organs of the plant. When growth begins again, the proteins release amino-acids that are then trans located with other mineral nutrients (phosphate, calcium and magnesium) to the developing roots and shoots.

Phosphorus-deficient plants are retarded in growth because fewer phosphorus-containing compounds essential for photosynthesis and respiration are formed. The plants are often darker green than normal and a reddish colouration is occasionally seen due to the pigment, anthocyanin. A deficiency also affects the plant hormone balance thereby delaying flower initiation and decreasing the flower count. Excess phosphorus hastens the maturity of a plant. Root growth is more extensive than normal.

Potassium (K)

Potassium ions play an essential role, not by being part of the structure of plants, but by exerting a regulatory function on reactions and processes. Potassium ions play an important role in the steps involved in the conversion of amino-acids to proteins. The most important function of potassium ions in plants is in the control of the movement of water into, and out of, cells by a process called osmosis.

Potassium-deficiency symptoms are first seen in the older leaves because potassium ions are readily trans located to the younger leaves. A potassium deficiency also results in a loss of turgidity of cells so that the plants "wilt" because less water enters the vacuoles by osmosis.

Plants lacking potassium are more susceptible to fungal diseases, probably due to an accumulation in plant tissue of unused sugars and amino-acids which provide the food for the attacking organism. Under these conditions the roots are readily affected by rotting. Some potassium-deficient plants are more susceptible to frost damage. An excess of potassium can affect the uptake and availability of magnesium and calcium to a plant.

Calcium (Ca)

Calcium can be supplied to plants as calcium nitrate, calcium dihydrogen phosphate and calcium sulphate (gypsum). Small quantities are present in most natural waters and may be slowly released from the potting mixture if marble chips (calcium carbonate) or shellgrit (calcium carbonate) or dolomite chips (calcium carbonate and magnesium carbonate) are present. Calcium pectate also helps to make the plant less susceptible to fungal diseases.

Calcium is required in regions of active cell division (for wall formation) particularly in the meristematic zones of roots and leaves. It is also needed for root extension and its absence causes the process to cease within a few

hours.Calcium plays a part in the movement of sugars and amino-acids within a plant.
With a calcium deficiency the growth of the plant is stunted. New leaves are limited in their development, the tips tend to die, a paleness is shown along the edges with some twisting and perhaps inward curling, and black necrotic spots may appear. The effect is most noticeable in the meristematic area. Roots are particularly sensitive to a calcium deficiency. Growth is severely affected - young roots and root hair may die and older roots turn brown.
A lack of calcium may also affect the flowering of the plant.

Magnesium (Mg)

Magnesium is generally supplied to plants as water-soluble magnesium sulphate (Epson Salts) but some may be received in small amounts if dolomite ($MgCO_3$, $CaCO_3$)

A deficiency of magnesium leads to a reduction in photosynthesis as insufficient chlorophyll is produced. A lack of magnesium ions also affects protein synthesis so that the rate of plant growth is reduced.

Sulphur (S)

Sulphur is generally received by plants as sulphate ions. These enter the roots from the surrounding solution and most are conveyed unchanged in the sap-conducting vessels (xylem) to the leaves.
A sulphur deficiency in plants, although not very common, affects protein synthesis and, to a lesser extent, photosynthesis. In most plants sulphur is not easily trans located. As a result, the deficiency symptoms are a light green to yellow chlorosis over the whole of new leaves including the veins. The leaves may not grow to their normal size.

Iron (Fe)

Many fertiliser mixtures contain this micronutrient in the form of pale green Iron (II) sulphate crystals. However, unless the pH of the nutrient solution is below 5, very little iron is absorbed through the roots because Iron (II) ions, react with water producing an almost insoluble substance.
Other iron-proteins also act as enzymes for reactions during plant growth.

Manganese (Mn)

Manganese is usually supplied to plants as Manganese sulphate. It is absorbed through roots from the nutrient solution as manganese ions, which are then transported in the sap of the xylem to the growing leaves.
A Manganese deficiency restricts the formation of chlorophyll. This results in a yellow mottling on both young and old leaves.
An excess of Manganese can reduce the uptake of Magnesium and Calcium. The symptoms observed are the appearance of dark purplish-brown spots.

Copper (Cu)

Copper is usually present in fertiliser mixtures as blue crystals of copper sulphate and enters the roots as either copper ions, or in a chelated form (e.g. with amino-acids). About 50% of plant copper is present in chloroplasts where it performs most of its functions, generally as an electron-carrier between the copper (II) and copper (I) states.
Copper is essential for the development of the anthers and ovaries of flowers. A copper-deficiency results in younger leaves being stunted in growth due to reduced photosynthesis. At the same time these leaves tend to wilt and become distorted because insufficient lignin is deposited in the walls of the

sap-conducting cells. The growing tip may eventually die. A copper-deficiency results in the non-viability of pollen.
Excess copper may affect the uptake of iron by plants.

Zinc (Zn)

This micronutrient is present in fertilisers as zinc sulphate and enters the plants through the roots as zinc ions. One of the most important functions of zinc is in the synthesis of the growth hormone, auxin, in meristems and new leaves.
Zinc activates, or is present in, many different types of enzymes. It is essential for protein synthesis.
Zinc enzymes are also responsible for the transport of certain sugars as phosphates between chloroplasts and the cytoplasm.

Boron (B)

Boron is present in fertiliser mixtures either as sodium borate (Na2B4O73BO3)
Plants can tolerate only a narrow range in concentration (about tenfold) between deficiency and toxicity limits - about 0.5 to 6 ppm of boron in the nutrient solution given to the plants.
Many functions of boron are not fully understood but unlike other micronutrients this element does not occur in, or activate, enzymes.
Boron is an important constituent in cell-walls and plasma membranes of growing tissue including the roots.

Molybdenum (MO)

Very small amounts of ammonium molybdate are necessary in fertiliser mixtures. The dry tissue analysis of healthy plants shows only about one part of molybdenum in ten million is present, much lower than for any other essential micronutrients. Molybdenum enters the plant as molybdenum ion.
Molybdenum is found in a few enzymes but its most important function is in the initial stage of protein synthesis. A molybdenum-iron protein (nitrate reductases) assists in the conversion of nitrate to nitrite in the cytoplasm of leaf-cells.
This element is also required for the production and viability of pollen.
A molybdenum deficiency in plants is rare. Symptoms are mottled, pale yellow colourations between the veins.

Chlorine (Cl)

Chloride ions are widely present in natural waters and after entering the roots readily move unchanged throughout the plant.
Most plants absorb up to 100 times very small amount of chloride that is essential for optimal plant growth. These chloride ions assist in achieving a charge balance with positive ions in plant solutions and, by entry into vacuoles, help to maintain the turgidity of cells brought about by osmosis.
Chloride ions activate as enzyme (asparagine synthetases) for one of the series of reactions involved in the conversion of ammonium ions to amino-acids.

ORCHIDS - EXPORT & MARKETING

Although Orchid breeding is in a nascent stage in India, several variety of hybrids can be generated through a planned Orchid Multiplication programme. With a range of 1200 variety species in existence we have one of the finest gene pool's that any country can be proud of.

Japan, Australia, Europe, Switzerland and USA are some of the major buyers of the Orchid cut flowers. By participation in international Orchid shows and exhibitions, awareness of our quality productions can be enhanced. As the flower fashions change, the availability of the varieties fluctuates. In fact, the world of cut flowers is like any other big business. It changes to keep up with customers demand, and it innovates and develops its techniques of productions.

The real emphasis is on export and re-export of cut flowers. So it is the requirement of the overseas market that governs productions. Growers and exporters look for the types of orchid that the customers desire, usually by choice of colors and form. Presently, the trend is for lighter colors with small round petals. However, the trend may change just as with fashion.
Therefore more durable criteria that the growers and exporters use in evaluating their commercial Orchids for cut flowers are that blooms must last for more than a week after cutting, the plant must be fast and easy growing, it must be resistant to pests and diseases and it must produce at least eight to ten saleable flower sprays per annum.
Quality control is essential. It has to be taken into account at every stage, because production can be only by as good as the weakest link.
Quality control could be broken down into these heads.

- **Selecting the right hybrid for commercial use.**
- **Good method of tissue culture for clonal propagation.**
- **Proper shading and cultivation density.**
- **Proper skill and technical knowledge in cultivation from healthy seed lings to productive plants.**
- **Good from Hygiene with a non polluted water supply**
- **Correct pre and post harvesting care, with good packing methods, including proper cutting and refreshing stems.**
- **Quick and efficient transportation and handling.**

Cultivation techniques can affect the quality and durability of the flower sprays. Each hybrid needs different cultivation and care. Orchids may not be difficult to grow, but to have reliability high quality standard blooms is difficult as even variation is the weather that can affect the standard and grade. Orchids are sensitive flowers.
Orchids for export have to be packed in suitable ways to preserves their lasting qualities and freshness. Packing should be immediate to minimize water loss, but the blooms may need first to be dried to prevent water droplets on the bloom doing damage or causing fungus problems. The packing procedure involves cutting the end of the stem at 45% slant with a sharp blade. The stems should then be instantly put into individual water tubes or moist cotton swabs and wrapped, a few at a time, in perforated polythene with

ventilation. The sprays need to be protected with corrugated cartons for export.
Documentation for export depends on the importing country's requirements. Usually a phyto sanitary certificate is needed to declare that the Orchids are free from pests and diseases. Sometimes an export permit under CITES may be needed to declare that the flower are free from artificially propagated plants and not from the wild.
Which Orchid are grown depends upon the different overseas markets and their respective seasonal demands. Oncidiums and Pastel dendrobiums are good for the Japanese market. They have many gift receiving occasions such as Mother's day, Valentine's day, year-end gifts, respect for the aged, Summer gifts, White day, Boys and Girls day.
There is also good demand during the wedding months of May, June and December, and during the prayer month of Obon, which falls in July in Tokyo and August in Osaka. European countries take more Vandaceous Orchids, such as the Arandas and Mokaras and the demand goes up during Christmas. Unfortunately in non-seasonal climate, it is hard to cope with seasonal fluctuations in demand, however at least the plants flower the year round and are not restricted to a single season.

In the long run, a breeding program tailored to seasonal demands might produce a range of Orchids blooming respectively at peak periods, but the lag time in developments of this nature is rather long. Infact the time lag depends also on the confidence of the growers in a new hybrid. It depends on whether or not the hybrid is field-tested. Without a field test, it is about three years from tissue culture to blooming, and this allows a relatively quicker reaction to market trends, assuming the hybrid is available in the first place. If field-testing is carried out, this doubles the time. This method, which only applies tissue culture to the selected best plants in the initial batch is safe or fool proof, as it is a trial of both production and marketability. However the disadvantage is that the market trend may have changed by the time the tested strain comes on to the market in real quantities.
Exporting orchids to countries like the USA, Canada and the Nordic countries of Europe initially will be tough owing to the high freight cost. But exploring the markets of Korea, Taiwan and Hongkong , where freight charges are low. But the markets in these countries are used to low priced orchids usually from Thailand. Indian exports can certainly catch and give the Thailand orchids a run on lower prices.


Fresh
Orchids
Fresh

FINANCIAL ASPECTS OF THE PROJECT :

Normally an orchid project for around 1acre or 4000 sqm takes around 25 – 40 lacs depending on the type of orchids cultivated. Detailed financial calculations are required for evaluating shade houses, type of plants, age of plants, Pots, Potting media, running costs, maintenance, Packing and post harvest systems, transportation and logistics etc. Mostly the shade house forms around 15 lacs for cost inputs and plants take around 15-18 lacs for around 25000 plants, and balance for irrigation, fertigation and management costs.

CONCLUSION:

Flowers have captured a remarkable place in modern culture. So there is a latent demand for flowers especially with regards to orchids as they keep very well and a plethora of choices in flower form and colour.
The growers with their experience in running successful enterprises both in agro sector and other Industrial activity and with able technical assistance from experienced growers can certainly run the project to successful fruition in a short gestation period.

The companies intention to export part of the produce in the foreign markets who have a regular demand augers well and the timing is also apt as the Indian Floriculture scenario has matured very well in the last 10 years.
With major markets located in Holland, Switzerland, Germany, France, UK, USA, and Japan… The company has tremendous potential to expand the selected products to several acres in the coming years.
The advantage of location benefits, labour expenses and cost of cheaper inputs can propel an Indian unit to produce quality at a better International market price.

We hope good management practices and better technology can change the output of this Industry to better heights.

THANK YOU

FOR ALL TECHNICAL QUERIES
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