

Organic Production of *Cymbidium* Orchids

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Abstract

Cymbidiums are highly valued for genetic resources, cut flowers, hanging baskets, potted plants and herbal medicines. In India, its cultivation is limited to Sikkim and the surrounding region of West Bengal covering Kalimpong, Darjeeling and Mirik. Higher elevations of 1500 - 2000m with cool summer night and monsoonal summer rain are ideal for *Cymbidium* cultivation. *Cymbidiums* are propagated sexually through seeds and asexually through division or backbulbs and through micropropagation for production of disease free and true to type plants. Greenhouse with all sides open is suitable for *Cymbidium* cultivation. A healthy growth growing media should contain leaf mould, coconut husk, tree barks or dry leaf ferns and brick pieces (1:1:1:1). During potting of *Cymbidium* seedlings in 10 - 12 cm pot, application of dried poultry manure @10g/pot as basal dose and weekly drenching of vermiculture wash (1:20) will help in growth and flowering *Cymbidium*. Organic manure comprised of mustard oil cake, dried fish and bone meal (8 kg: 0.5 kg: 4 kg) is also beneficial for *Cymbidium*. A healthy well grown orchid will produce flowers spikes every year and a plant 10 years old can produce from 10 to 20 flower spikes. In *Cymbidium*, flowers having 75% bloom stage or two buds opened stage with the spike length of 60-90 cm are harvested. In *Cymbidium* 'Ensikhan' and 'PCMV', 4% sucrose + 100 ppm salicylic acid and 4% sucrose + 100 ppm $Al_2(SO_4)_3$ are used as bud opening chemicals and 2% sucrose + 200 ppm 8-HQS is also used as holding solution.

Keywords: *Cymbidium*; Orchids

Introduction

Improper farming practices such as monocropping, imbalanced fertilization, poor soil organic matter management, soil contamination, soil compaction, mining of soil nutrients, water logging, depletion of ground water, decline in soil biodiversity and changing insect pests and disease complex and application of imbalanced NPK fertilizers ratio of 7.9:3:1 as against normal values of 4:2:1 are the major factors for soil degradation. Looking the adverse effects of fertilizers and chemicals emphasis is being given to promote organic farming. The data indicates that per consumption of fertilizers and pesticides in India is 91.5 kg and 0.38 kg, respectively which are far below than other countries. The unprecedented rise in population will lead to the increased demand of food. The projected population for 2020 is 154 crores for which there will be a requirement of 385 million tonnes of food grain [1].

Among cut flowers, *Cymbidium* consists of 70 semi-terrestrial and epiphytic orchids of tropical and subtropical Asia. The plants are characterized by short and stout pseudobulbs ensheathed by encircling leaf bases. Leaves are long, ribbon shaped, leathery or soft and lanceolate. The flower spikes develop from the base of the pseudobulbs. The spikes are erect, arching or pendulous and arranged with 2 to 15 flowers. The individual florets are 1 to 12.5 cm across and are of various colours shades. *Cymbidiums* are famous

for its beautiful spikes derived from species and hybrids. Among the orchids, *Cymbidium* ranks first and in floricultural crops it accounts for 2.7% of the total cut flower production. *Cymbidium* hybrids are classified into three groups-Standard, Intermediate and Miniature hybrids. Standard and Intermediate hybrids produce 90 to 120 cm long spikes with 8 to 15 flowers per spike. Miniature hybrids produce green, yellow or brown coloured flowers, 30cm tall and each spike contains 30 - 40 flowers of 2.5 to 8.5 cm across. Novelty or Intermediate hybrids have been evolved by crosses between Miniature and Standard hybrids [2].

Importance and uses

Cymbidiums are highly valued for genetic resources, cut flowers, hanging baskets, potted plants and herbal medicines.

Genetic resources for hybridization: *Cymbidium iridioides*, *C. eburneum*, *C. hookerianum*, *C. sanderae*, *C. lowianum*, *C. tracyanum*, *C. insigne*, *C. erythrostylum*, *C. ensifolium*, *C. devonianum*, *C. tigrinum*, *C. atropurpureum*, *C. finalaysonianum*.

Cut flowers: Both standard and novelty hybrids are used as cut flowers.

Standard types: Valley Legend Staff, Soul Hunt 6, Forest King, September Sunset, Mini Moon Tiger, Golden Girl, H.C. Aurora, Levis Duke, Margaret Thatcher Perfection, Baltic Glacier Mint Ice, Break

Out Flame, Black Flame, Valley Zenith Concord, Magic Kiwi Winner, Magic Kiwi Double Delight, Pure Jungle Crown.

Intermediate types: Ammes bury, Show Girl Cooks Bridge, Platinum Bird, Jungfrau Snow Queen, Golden Elf, PCMV, Velvet Green, Red Imperial Red Tower, Luna Pink Champion.

Potted types: Ice Cascade, Mini Sara Jean.

Growing requirements

In India, its cultivation is limited to Sikkim and the surrounding region of West Bengal covering Kalimpong, Darjeeling and Mirik. Other North Eastern states like Nagaland and Arunachal Pradesh are also promoting this flower. Higher elevations of 1500 - 2000m with cool summer night and monsoonal summer rain are ideal for *Cymbidium* cultivation.

Light: A full morning sun or bright dappled afternoon shade during summer and full sun in winter is ideal. Mature plants need 50 - 55% shade during hot weather. During growing season they require upto 5000 - 6000 f.c. light whereas in flowering season upto 2000 - 3000 f.c. light. Foliages should be yellowish green in colour.

Temperature: In general, *Cymbidiums* can tolerate as low as temperature of 7°C. In vegetative stage, plantlets grow best at temperature of 18°C at night and 24-30°C during the day. A temperature of 10 - 15°C is required for initiation of flower spikes. During the winter season (late October to late February) a temperature of 7 - 12°C at night and 18 - 24°C during the day is maintained. Miniature hybrids can withstand 5°C higher temperature than standard *Cymbidiums*.

Relative humidity: An optimum range of relative humidity is 50 - 80% and important for good growth and flowering. During hot weather, misting down the plants and the surrounding floors and benches maintain humidity. Humidity prevents from crinkling of leaves.

Propagation: *Cymbidiums* are propagated sexually through seeds and asexually through division or backbulbs. Division means splitting the plants into two to three parts each with one new shoot and each will produce an individual plant. Propagation through back bulb is a slow process which will take three to four years to give a flowering size plant.

Tissue culture is the only way to produce millions of disease free and true to the type plants in shortest time. In this method, callus (amorphous masses of cells), meristems and organs (root, leaf, flower, embryo, ovary, fruit, seeds etc) are isolated and cultured aseptically in laboratory supplied with defined media containing sugars, inorganic salts, vitamins and growth regulators.

Growing structures

Greenhouse with all sides open is suitable for *Cymbidium* cultivation. In mid hills, simple bamboo/wooden structure with UV stabilized polyethylene on the top is generally used with success. However, structure with steel pipe and top covered with double layered polycarbonate and encircled with 50 mesh and iron net is suitable for *Cymbidium* cultivation. Greenhouse fabricated with galvanized steel pipe and covered with polyethylene is most often used for *Cymbidium* cultivation. *Cymbidium* can be grown in cost effective cooled green house with automation system of temperature, light, humidity and aeration. In India, the direction of house should be North-South to trap the maximum sunlight. The central height of greenhouse should be 5 - 6m and side height atleast 4m in mid hill conditions.

Benches

The ideal bench should be made of galvanized iron pipe of 50 meshes with a maximum 75 cm in height and maximum 90 cm in breadth to hold the weight of sufficient number of pots. The benches can be made up of concrete or split bamboo also.

Pot

The most commonly used are earthen or plastic pots to hold the media. The pots must have sufficient number of holes for aeration to root zone and draining out excess water. One year old plants should be planted in 4 inches pot. Thereafter, it needs to be transferred in 6 inches pot. Smaller plants of less than 15 cm should be planted in the community pots to check the mortality. The full grown bearing plants are planted in 10 to 12 inches pot.

Growing media

A healthy growth growing media should contain leaf mould, coconut husk, tree barks or dry leaf ferns and brick pieces (1:1:1:1) [3]. The pH of the potting media should be 5.5 to 6.5. The electrical conductivity (EC) 1.05 mhos/cm is good for growth.

Potting and Re-potting

The potting should be done during active growth phase (April to June) after flowering. Crocks or brick chips should be placed at the bottom of the pot. The plant then placed centrally and sterilized media need to be placed all around the plant. *Cymbidiums* usually need to be repotted about every three years under normal conditions. March to June is the actual period for repotting of pot bound *Cymbidiums* in Indian conditions. Generally, it is best to divide the overgrown plants by breaking the rhizomes between the pseudobulbs. While dividing or repotting, a division should have one backbulb, one old bulb and one young bulb.

Spacing

About 15 - 20 plants can be accommodated in one to one and half year old plants in a square meter year. The spacing will be wider as a plant grows and 6 to 9 adult plants of 3 - 4 years age in 6 inches pot can be accommodated. However, fully grown plants require more space for aeration and 3 - 4 plants can be spaced in a square meter area.

Organic nutrient management

The potential organic sources of plant nutrients are green manure crops, crop rotation, crop residues, organic manures, FYM, Night soil, sludges, oilcakes, blood meal, compost, phospho-compost, vermin-compost, biogas slurry, agricultural wastes, press mud, Biodynamic preparations, biofertilizers etc [4]. Traditional additives comprises of bulky organic manures mainly Farm Yard Manure (FYM) for improvement of soil total nitrogen [5]; compost which can be prepared from crop residues, weeds and vegetative biomass, sugarcane trash and pressmud, coir waste, tea waste; green manures obtained from sunhemp, *Sesbania aculeate*, cowpea, cluster bean; sewage and sludge from cities and towns; sheep, goat and poultry manure; concentrated organic manures viz. oilcakes like castor cake, karanj cake, cotton seed cake, mahua cake, safflower cake, groundnut cake, linseed cake, rapeseed cake and sesame cake; meat meal, blood meal and fish meal which have adequate amounts of NPK (0.5 - 2.0% N, 0.2 - 1.0% P₂O₅ and 0.5 - 2.0% K₂O) and higher C: N ratio.

Cymbidiums are heavy feeders for their robust growth of bulbs and leaves. Application of organic manure increases the water holding capacity, aeration of growing media, allows root development and modify media temperature. During potting of *Cymbidium* seedlings in 10 - 12 cm pot, application of dried poultry manure at the rate of 10 g/pot as basal dose and weekly drenching of vermiculture wash (1:20) will help in growth and flowering *Cymbidium*. Organic manure comprised of mustard oil cake, dried fish and bone meal (8 kg: 0.5 kg: 4 kg) is also beneficial for *Cymbidium*. It contains 3.5% nitrogen, 2.1% phosphorus, 2.7% potassium, 4.5% calcium and 1.6% Mg. The mixture is prepared by decomposing for 21 days in water followed by sun drying. 5 g of this organic mixture at 6 monthly interval and weekly spraying of vermiwash is beneficial for 2-3 years old *Cymbidium* [6].

Watering: In *Cymbidium*, watering is required all the year round to keep the pseudobulbs green and smooth. The frequency of watering is given below.

- Summer: 2-3 times per week
- Autumn: Once or twice per week
- Winter: Once per week
- Spring: As Autumn season

Harvest

The orchid flowers should be harvested at proper stage for getting quality flowers and maximum vase life. Morning is the best time for harvesting. Flowers are cut sharply with a knife or secateur and dipped immediately in a bucket of water. In most of the commercial orchids, the optimum harvesting stage is fully opened and mature flowers. A matured healthy plant in 10" pot under good management will produce about 4 - 6 flowers per year. A healthy well grown orchid will produce flowers spikes every year and a plant 10 years old can produce from 10 to 20 flower spikes.

Economics of cultivation

A *Cymbidium* grower can earn Rs. 20 - 25 lakhs in 10 years from an area of 500 m² accommodating 1500 plants after investing 10 lakhs and saling of 55000 - 60,000 cut spikes.

Insect pests and diseases

Insect pests

Mites, thrips, scale insects, aphids, mealy bugs, grass hoppers and shoot borers are common insect pests of *Cymbidium*. The all active stages (nymph and adult) of mite feed on under surface of leaves and flowers by sucking the cell sap from epidermal layer, especially along with midrib and the base. The loss of cell sap causes yellowing of leaves. Management of *Aphids*, *Macrosiphum luteum* on *Epidendrum* sp. is effectively managed with *Beauveria bassiana* at the rate of 2 ml/litre, neem oil (5 ml/l) and *Metarhizium anisopliae* (2 ml/l).

There are five predominant species of scale insects viz., ti scale, *Pinnaspis buxi*, florida red scale, *Chrysomphalus aonidum*; lecanium scale, *Lecanium* sp; soft brown scale, *Coccus hesperidum* and boisduval scale, *Diaspis boisduvali* which cause damage on orchids round the year. Both the stages of scale insects suck the cell sap from leaves, pseudobulbs, flower buds and flowers cause yellowing of leaves, vigor loss and stunted new growth. In case of heavy infestation, infected plants become deformed, sticky honeydew excreted which attracts sooty mould on which dust particles deposited as resulted that photosynthesis rate affected. Botanical products from neem viz. azadirachtin (neem oil 0.03% EC) at the rate of 5 ml/L and *Allium sativum* give effective management of boisduval scale insect under polyhouse conditions

Two species of aphids like yellow aphid, *Macrosiphum luteus* and black aphid, *Toxoptera aurantii* mainly cause damage to orchids. The nymphs and adults suck the cell sap usually from new flower spike and foliage. They also excrete honeydew on which sooty mould developed that affect the photosynthesis. Thrips, *Dichromothrips nakahari* suck the cell sap from tender portion of plants and on leaves, it become discolored and shrivels. Both young once and adult of mealy bug (*Pseudococcus* sp) suck the cell

sap from the leaves and petioles or any joint portion of plants and as a result of that plants become weakened. Grass hopper (*Hieroglyphus banian*) feed on young leaves, un-opened flower buds and flowers by cutting in irregular shape with their biting and chewing type of mouth parts and ultimately flowers quality affected.

Diseases

Black rot, Crown rot or heart rot (*Pythium ultimum*, *P. splendens*, *Phytophthora palmivora* and *P. parasitica*): Water soaked small brown spot on the aerial parts of plants, which quickly turn black. Fungicides spray viz Captan at the rate of 2 g/l or Zineb at the rate of 2 g/l water controls it.

Anthraxnose (*Colletotrichum gloeosporioides* and *C. orchidacearum*): Initial symptom appears as the small oblong to circular oval, sunken and reddish brown to dark brown or gray coloured spots. Die back of leaves are also observed if the leaf tip is attacked. Spraying of Carbendazim (Bavistin) at the rate of 1 g/ litre in 10 days interval checks the disease.

Blossom Blight (*Botrytis cinerea*): The pathogens produce numerous small dark spots on petals, especially on older flowers. Sometimes shot hole effect is found on infected flower petals. Spraying with Bavistin at the rate of 1 g/l liter or indofil Z at the rate of 2 g/ litre at 7 days intervals are effective.

Bacterial soft rot (*Erwinia carotovora pv.carotovora* and *E. chrysanthi*): Deep greyish grey lesions on leaves. It causes leaf spot, soft rot and stem rot with fishy smell. Treating of infected plants with streptomycin or oxy tetracycline solution before planting.

***Cymbidium* mosaic virus** (*Cymbidium* mosaic potexvirus): The virus produces variable symptoms on different hosts. It produces mild or severe mosaic symptoms followed by necrosis. Start with certified and virus free plant material, Proper sterilization of tools used in cultural practices, proper distance among plants has to be maintained to avoid virus infection, proper sanitation. Keep growing area free from plant debris. Quarantine new plants and Control of insect vectors.

Odontoglossum ringspot virus : (Tobamovirus): It produces ringspot on *Odontoglossum grande*, diamond mottle symptoms. Start with certified and virus free plant material, proper sterilization of tools used in cultural practices, proper distance among plants has to be maintained to avoid virus infection, proper sanitation. Keep growing area free from plant debris. Quarantine new plants and control of insect vectors are remedial measures.

Postharvest management

A good quality cut flower of an orchid should have the following characteristics [7]:

- Minimum eight standard blooms per stem
- Flowers must be cleaned, evenly coloured and free from physiological disorders
- Stem must have flowers evenly arranged and around the stem.
- Two third of the stem should be covered with the flowers.
- Flowers must have a firm texture and a luminescent sheen
- Stems must be firm when held up
- The minimum base diameter of the stem should be of 10 mm.

Stage of harvest: In *Cymbidium*, flowers having 75% bloom stage or two buds opened stage with the spike length of 60 - 90 cm are harvested.

Grading: In *Cymbidium* orchids are graded in the following way [8]:

Category	Grade	Flower Count	Spike length
Standard	AAA	> 12	1.25 m
	AA	8	90 cm
Miniature	XL	- 12	65 cm +
	L	12 - 14	55-64 cm
	M	8 - 11	40-54 cm
	S	< 5	30-39 cm

Packing: After harvest the flower stems are bunched into 5 or 10 and wrapped in a specialized polythene cover and at the base of the stem a slant cut is made with a sharp knife. The stem bottom is inserted in a plastic plug containing clean water. This will keep the flowers fresh during transportation. In absence of the plug moistened cotton wrapped with a piece of polythene can do the job for domestic market. After plugging or wrapping with moistened cotton, the flower stems are placed in corrugated boxes and readied for dispatch to the market.

Storage: 0.5 to 5oC for 14 days under dry.

Floral preservatives: In *Cymbidium* hybrid 'Red Princess' pulsing with 5% sucrose increases vase life upto 56 days followed by sucrose at the rate of 8% (54.78 days). In *Cymbidium*, 1-MCP and AVG are superior than STS in prolonging the vase life of cut flowers. In *Cymbidium* hybrid, 'Red Princess', 75% open flowers with 200 ppm 8-HQS showed highest vase life along with cent percent opening. In *Cymbidium* 'Ensikhan' and 'PCMV', 4% sucrose + 100 ppm salicylic acid and 4% sucrose + 100 ppm Al₂(SO₄)₃ are used as bud opening chemicals. 2% sucrose + 200 ppm 8-HQS is also used as holding solution



Conclusion

The orchids have taken a significant position in cut flower industry due to its attractiveness, long shelf life, high productivity, right season of bloom, easy in packing and transportation. *Cymbidiums* are highly valued for genetic resources, cut flowers, hanging baskets, potted plants and herbal medicines and they fetch the highest price in the international markets of which major Asian markets of Singapore and Japan or the Dutch market. They have great po-

tential for commercial cultivation in subtropical to temperate regions of Sikkim, Arunachal Pradesh and West Bengal (Darjeeling) states with cool summer, heavy rainfall and cold winter. These floral crops are organically viable with locally available growing media such as leaf moulds, green moss, tree barks, leaf ferns etc. The growth of orchid exports from north eastern hill region especially Sikkim would provide opportunities for employment and also for development of supporting industries like packaging, cold storage and transportation.

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