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## POST-HARVEST TECHNOLOGY OF DENDROBIUM ORCHIDS

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# POST-HARVEST TECHNOLOGY OF DENDROBIUM ORCHIDS

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## INTRODUCTION

Globally, trade on artificially propagated live plants are dominated by orchidaceae hybrids (28.7%), Cymbidium species (26.9%), orchidaceae species (18.9%), Phalaenopsis hybrids (10.1%), Phalaenopsis species (4.4%), Dendrobium species (3.4%), Cymbidium hybrids (3.3%), Dendrobium hybrids (2.3%), Cattleya species (0.4%) and Oncidium species (0.2%). Dendrobiums are popular potted flowering plants and cut-flowers around the world due to their floriferousness, wide range in flower color, size and shape, year round availability, and lengthy vase life (Gupta and Saravanan, 2017; De and Pathak, 2018). Hawaii, California, and Florida are major potted *Dendrobium* growing regions in the United States. In The Netherlands, production of potted orchids is now 40 to 50 million units with *Dendrobium* increasing in popularity. Thailand holds a particularly strong position in *Dendrobium* orchids. It is estimated that 54% of the orchids produced in Thailand are currently exported, while the remaining 46% are consumed in the domestic markets. The export value of orchid cut-flowers has increased sharply to about 60 million USD in 2014. Simultaneously, the

export of orchid plants has also rapidly increased to about 22 million USD in 2014.

## Important hybrids of Dendrobium orchids

**White:** ‘Snow White’, ‘Pagoda White’, ‘Emma White’, ‘White Surprise’, ‘Jacquelyn Concert x Walter Oumae’, ‘Kasem White’, ‘Big White 4N’, ‘Big White Jumbo’, ‘White 5N’

**Blue:** ‘Vorawit Blue’, ‘Lee Chong Blue’, ‘Kultana Blue’, ‘Kiyoshi Izumi’, ‘Blue Fairy’, ‘Lee Chong Blue’, ‘Bangkok Blue’

**Pink:** ‘Chiengmai Pink’, ‘Ekapol Panda’, ‘Jisu’s Star’, ‘Juree Red’, ‘Kiilani Stripe’, ‘Long Champ’, ‘Penang Sugar’, ‘Sagura Pink’, ‘Miss Singapore’, ‘Madam Pink’, ‘Sonia -16’, ‘Ear Sakul’, ‘Candy Stripe Pink’, ‘Sonia-17’, ‘Sonia -28’, ‘Dr. A. Abraham’, ‘Madam Pompadour’.

**Yellow:** ‘Sri Siam’, ‘Swan Lake’, ‘Thongchai Gold’, ‘Bonchoo Gold’, ‘Sarifa Fatima’

**Green:** ‘Daangsaard’, ‘Kanjana Green’, ‘Green Mist’, ‘Little Green Apples’

**Red:** ‘Meike Beauty’, ‘Pathum Red x Sabin’, ‘Little Lolita’, ‘Cleopatra’, ‘Diamond Star’, ‘Fireball’, ‘Little Lolita’, ‘Kating Daang’.

## Post-harvest life of Dendrobium due to varietal differences:

The spike length varies from 21.9cm in ‘Burana Stripe’ to 47.7 cm in case of ‘Madam Pink’. ‘Madam Pink’ had highest number of florets/spike (15) while ‘Emma White’ had minimum (5.4). Flower diameter was recorded maximum in ‘Erika’(15) followed by ‘Kating Dang’(12cm). Longevity on plants was recorded highest in ‘Ear Sakul’ (71 days) and lowest in ‘Daang Saard’ (33 days). The hybrid ‘Triple Pink’ had the highest vase life (40 days) and lowest in ‘Madam Pink’ (15.3 days) (Table 1).



**Table 1.** Vase life of different Dendrobium hybrids

Name of Hybrids	Spike length (cm)	No of florets /spike	Diameter of floret (cm)	Longevity on plants (days)	Vase life (days)
Big White 4N	36.7	9	7.3	54	20.6
Bangkok Blue	34	11	5.4	48	21
Big White Jumbo	31	7	6.8	41	29.5
Madam Pink	47.7	15	6.8	44	15.3
DaangSaard	25.5	10	6	33	27.5
Erika	41.9	6.2	15	50	34.8
Julie	29.25	12	3.5	38	25
Kating Dang	28.7	6.7	12	45	28
Lervia	22.8	7.8	5.25	41	28.2
Madam Pompadour	32	9.6	6.25	50	37
Burana Stripe	21.9	6.4	6	70	40
Emma White	26.9	5.4	6	50	37
Ear Sakul	30	9	7.5	71	33.5
Thongchai Gold	25.4	7.6	10.5	69	30.4

**Some Dendrobium orchid hybrids for cut flowers**

		
Dendrobium 'Kating Dang'	Dendrobium. 'Emma White'	Dendrobium. 'Big White 4N'

## HARVEST FACTORS

At bud stage, out of 12 hybrids of Dendrobium, maximum vase life recorded in Den. Big White Jumbo (45 days) and maximum per cent of fully opened flowers in Den. Kating Dang (45%). At 50 % opened stage, highest vase life recorded in Den. Big White Jumbo (60 days) and more than 90% fully opened flowers recorded in Den. Big White Jumbo, Thongchai Gold and Lervia.

## POST-HARVEST FACTORS

**Effect of pulsing:** Pulsing may be used by growers, wholesalers or retail florists in order to enhance the cut flowers subsequent vase life in water. Pulsing is employed with higher concentrations of sugar, mainly sucrose, the percentage of which varies with species and cultivars. Other chemicals used in the pulsing treatments are STS, AgNO<sub>3</sub>, HQ, MH, AOA, CaCl<sub>2</sub>, CoCl<sub>2</sub>, nickel sulphate, aluminium sulphate and benzyladenine. Pulsing is found to be of great value in prolonging life, promoting opening and improving the colour and petal size of petals through osmo-regulation. In *Dendrobium* hybrid 'Pompadour' pulsing with 25ppm AgNO<sub>3</sub> + 135 Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, 5H<sub>2</sub>O for 30 minutes increases vase life of cut flowers. In *Dendrobium* cv. 'Sonia' pulsing with 4% sucrose + 400 ppm HQ recorded the highest vase life of 21.33 days. Inflorescences pulsed with 6 % sucrose + 400 ppm HQ recorded the highest sugar content in the flowers (27.64%).

**Effect of chemicals on bud opening:** It is a procedure of harvesting flowers at a stage earlier than normally considered as the cutting stage and then opening the buds off the plant. Such types of post harvest handling may be applied by growers or wholesalers. Bud opening of flowers increases longevity of cut flowers by reducing the sensitivity of flowers to extreme temperatures, low humidity and ethylene, saving space during shipment and extending the useful storage





life. The sugar concentration used is lower than the concentration of pulsing and the optimum temperature is kept lower. In *Dendrobium* hybrid, ‘Thongchai Gold’ opened flowers had 29%, half opened flowers had 28.25 % and buds had 16.17% reducing sugars. In *Dendrobium* hybrids, HQS or AgNO<sub>3</sub> (50ppm) is effective for opening of tight bud cut flowers.

In *Dendrobium* hybrid ‘Thongchai Gold’, per cent of fully opened buds (66%) was recorded maximum with sucrose(4%) + Ca(NO<sub>3</sub>)<sub>2</sub> (1%) followed by sucrose (4%) + acetyl acetic acid (100 ppm) (60%). Longest vase life (36 days) was found with sucrose (4%) + Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> (100 ppm) followed by sucrose (4%) + acetyl acetic acid (100 ppm) (33 days).

**Grading:** The export quality orchids are graded to maintain high standards of excellence. Sprays are graded according to length, colour, flower size etc. The grading is done in four standard sizes, based on the quality of the stalk and spike length for each grade (Table 2).

**Table 2.** Grading in *Dendrobium* orchids

Grade	Spike length	No. of opened flowers
Small (S)	30cm	4-5
Medium (M)	40cm	6-8
Large (L)	45cm	8-10
Extra Large (XL)	50cm	>10

**Packaging in *Dendrobium* orchids:** The flower spikes of *Dendrobiums* are first sleeved in polyethylene sleeves of standard thickness. The standard is to bunch around 5 spikes of the same grade and variety in a pack box. Each stem in the box should be placed in the tube containing water or preservative solution. Instead of small tube cotton wrapping can also be used, in this case cotton pieces should be dipped in water or preservative solution. Then the piece of

polythene can be used to cover the cotton and it should be tied with rubber band. And cushioning materials should be provided in the back side of the sleeve to avoid the damage during transportation. Then these graded flowers are packed in suitable size of boxes. In order to check movement of spikes within the boxes during transit the base of the spikes should be tied to the base of the carton by adhesive tapes. *Dendrobium* flower spikes are normally packed in carton of different sizes. The length of the carton varies mainly based on the length of the flower spikes. The carton should be provided with sufficient numbers of holes or vents for aeration. The carton is exclusively designed to ensure better care of the flowers and help reach their destination in pristine conditions. The box dimensions for packaging of cut *Dendrobium* orchids should be 60 cm length, 40cm width and 52cm height.

**Storage of cut flowers :** Low temperature treatment during storage or shipment period reduces the entire metabolism in the tissues, slowed down the respiration, transpiration and ethylene action and retarded the multiplication of bacteria and fungi. In general, temperate orchids like *Cymbidiums* are stored at lower temperature even below 5°C in cold chambers whereas tropical orchids such as *Dendrobiums* are stored at 7-10° C. A 90-95 % relative humidity is necessary during storage to minimize moisture loss and to prevent wilting. There are two types of cold storage methods, namely ‘Wet storage’ and ‘Dry storage’. In wet storage, flowers are stored with their bases dipped in water or preservative solution for a short time. Dry storage methods are used for long term storage. In this method, fresh flowers are harvested in the morning, graded and sealed in plastic bags or boxes to prevent the loss of moisture.

**Transport of cut-flowers:** Being short lived and perishable in nature, flowers could be delivered to destination as early as possible



immediately after harvest. For long distance markets, cut flowers are transported by cargo planes, merchant ships and trucks. Other modes of transportation were head loads, bicycles, two-three wheelers, cars, vans etc. Hence, for long distance transportation, advanced methods of post-harvest handling like cooling, conditioning, impregnation, pulsing, bud opening and packaging were followed. Orchids are supplied with water for long distance transportation. The base of the flower stem is placed in a vial or rubber balloon filled with water or wrapped in wet tissue. Short time pulsing of flowers with optimal concentration of sucrose, AgNO<sub>3</sub>, STS and growth regulators was important for long term truck and sea shipments.

**Drying of spikes and florets:** Embedded drying with borax, borax +silica gel or sand at 50°C-60°C in oven and embedded drying with perlite, perlite + borax and perlite + silica gel under room condition (24-25°C and 75-79% RH) are ideal for drying of spikes and florets of *Dendrobium* (De, 2020b) . Freeze drying is useful for drying of florets of *Dendrobium chrysanthum* and *D. moschatum*.

## ECONOMICS OF PACKAGING TECHNOLOGY

Yield of spikes varies from genus to genus and variety to variety. On an average, 6-8 spikes per plant are available from commercial varieties of *Dendrobium*. Pricing of spikes depends upon the type of orchid and the grade of spikes. The cost of one *Dendrobium* spike ranges from Rs. 10 to Rs. 25 depending upon the grade. The benefit cost ratio of packaging of *Dendrobium* spikes is 0.67.

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