Growing the Best Phalaenopsis

Part 4: A Complete Production Schedule

By Matthew Blanchard, Roberto Lopez, Erik Runkle, PhD, and Yin-Tung Wang, PhD

TOP An example of mass production of young phalaenopsis plants grown in community pots at a commercial nursery in The Netherlands.
ABOVE Young plants spaced after transplanting into 5-inch (12.5-cm) pots.
OPPOSITE Remay cloth can be used after planting to reduce light transmission as plants acclimate to a new growing environment.

IN THE PREVIOUS THREE ISSUES of *Orchids*, we have described the options for purchasing phalaenopsis starting material and discussed the important cultivation techniques involved in producing a flowering crop. In conclusion of our four-part series, we will put all of this information together and provide a simplified production schedule that can be implemented to fit your growing environment.

The production of phalaenopsis orchids can be divided into three phases:

Phase 1. Vegetative cultivation at high temperatures of 82 to 90 F (28 to 32 C)

Phase 2. Spike induction at low day temperatures of 63 to 77 F (17 to 25 C)

Phase 3. Finishing at 63 to 79 F (17 to 26 C).

Depending on your greenhouse facilities, climate and choice of starting plants, the production of flowering potted phalaenopsis can involve all three of these phases or may be limited to only one or two. As discussed in the January 2007 issue of *Orchids*, one option for growers is to purchase nonflowering immature plants that require additional vegetative growth before cooling and spike induction. A grower who chooses this option will use all three production phases. Alternatively, the vegetative phase can be omitted by purchasing mature plants of flowering size that are ready for the cooling phase. Growers who adopt this production strategy purchase plants that can be induced to spike soon after plants arrive and then finished in flower for a particular date. In some circumstances, plants with a visible spike that have already received cooling can be purchased. These plants are termed "pre-spiked" and are finished by the grower for flowering.

Many large commercial growers of phalaenopsis import young plants from other countries, either in flasks or as small bare-root plants. The first article of this series (January 2007) contains more information on importing plants from overseas. There are also several

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domestic producers of young plants who can provide actively growing plants in media.

Since May 2005, nurseries in the United States have been permitted to import potted phalaenopsis of all sizes grown in approved media from Taiwan. Although these plants were originally shipped to the United States by airfreight, due to high transportation costs most plants are now imported by sea freight. During transport by sea, potted phalaenopsis are packed in air-conditioned cargo containers and shipped in complete darkness for three to four weeks. When done properly, plant loss is less than five percent and mature plants can be immediately induced to flower upon arrival at the destination greenhouse. Research is currently being performed at Texas A&M University to learn how plant quality can be further improved.

With these options for purchasing plant material in mind, let's now discuss a simple schedule for producing a crop of flowering phalaenopsis.

PHASE 1: VEGETATIVE GROWTH A grower who purchases young immature plants will begin production of phalaenopsis with vegetative cultivation. For the large-flowered hybrids and clones, this plant material generally will not flower uniformly until plants have an average leafspan of 10 inches (25 cm) or greater. Therefore, plants are grown at high temperatures to promote leaf development and inhibit flowering.

Plants purchased in flasks are often transplanted into square or rectangular community pots, with about 40 or 50 plants per tray. After approximately 20 to 25 weeks of growth at high temperatures, plants are then transplanted into individual containers for the next stage of vegetative growth.

Plant material with an average leafspan of 8 inches (20 cm) is often transplanted into 5-inch (12-cm) pots. Spacing depends on plant size and grower preference, but early in the production phase, plants can be spaced pot-to-pot.

Following transplanting, several irrigations may be necessary to sufficiently moisten the substrate, depending on the environmental conditions and medium composition. Due to the low water-holding capacity of fresh bark, newly transplanted material will need to be frequently checked for watering until the medium

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begins to hold more moisture. Alternatively, the addition of a surfactant (or a few drops of dish-washing liquid) to the water can reduce the surface tension of the media and improve water absorption. Media with high water-holding capacities need less frequent watering. If bare-root plants are planted in moist sphagnum moss, no watering is needed until the moss has become nearly dry. Light sprinkling daily also helps plant recovery during the first few weeks after transplant. Some growers place a thin layer of polyethylene fabric (e.g., Remay cloth) over benches for one to two weeks after planting bare-root plants to create diffuse light levels less than 1,000 foot-candles (200 $\mu mol \cdot m^{-2} \cdot s^{-1}$) and to increase humidity. This strategy helps to minimize plant stress and reduce plant loss after planting.

Young plants are grown at high temperatures in the range of 82 to 90 F (28 to 32 C), at least during the day, to promote vegetative growth and inhibit flowering. If environmental conditions are favorable, plants with a leafspan of 4 to 5 inches (10 to 12.5 cm) require approximately 22 to 27 weeks to reach flowering size. This duration depends on temperature, the initial leafspan, fertility and the size desired before the induction of flowering. On average, a new leaf will emerge every six weeks and will reach maturity after 10 weeks when grown at these high temperatures. As the growing temperature decreases, the rate of leaf development slows. When importing mature bare-root plant material from overseas, providing four to six weeks of growth in a warm environment after planting will be beneficial for rooting and subsequent flowering.

Growers should monitor light levels with a light meter and adjust shading to provide between 500 and 1,500 foot-candles (100 to 300 $\mu mol \cdot m^{-2} \cdot s^{-1}$) of diffused light at canopy level. Plants should be spaced as necessary to minimize leaf overlap and allow for adequate air circulation. During spacing, it is also a good idea to sort plants according to leafspan. Plants with a small leafspan will require additional time before the onset of the cooling phase.

PHASE 2: COOLING When plants have five to seven leaves and a minimum leafspan of 10 inches (25 cm), the cooling phase can begin to induce spiking. A grower that purchases mature potted plants may begin with this phase of production. Plants can be cooled at temperatures in the range of 63 to 77 F (17 to 25 C) for approximately four to six weeks. At the lower end of this temperature range, plants may produce two or more spikes. In most phalaenopsis hybrids, a spike (the potentially flowering stem) will usually become visible after three or four weeks of cooling. However, longer durations may be required for some hybrids or when plant material is smaller.

Cooling may take place in the same greenhouse section as the vegetative phase if all plants in that section are to be induced into flower. When only a portion of plants are to be induced into flower, a separate greenhouse section is needed for cooling. Providing low temperatures to young plants can induce variable premature spiking and slow down vegetative growth, both of which are undesirable.

PHASE 3: FINISHING The finishing phase describes the period from spike emergence through spike development and flowering. After cooling, plants may either be transferred to a separate finishing area for flowering or remain in the same greenhouse section used during the cooling phase. Plant spacing can be the same as during the cooling phase. Temperatures in the range of 63 to 79 F (17 to 26 C) are used during finishing. Since flower bud initiation begins when the spike has reached about 2 inches (5 cm) in length, maintaining temperatures between 63 and 68 F (17 to 20

C) until the spikes are 12 inches (30 cm) or longer can increase the number of flowers. Some hybrids grown at a cooler temperature may also have increased lateral branching of the inflorescence. It is important to avoid extended exposure to temperatures above 79 F (26 C) during this final phase. High temperature can reduce flower bud number and flower size, and flower buds may abort. In addition, prolonged exposure to high temperatures can induce a vegetative air plantlet to form on the spike (referred to as a "keiki") rather than flower buds.

Following spike emergence, the rate of development toward flowering is controlled by the average daily temperature. For example, in research conducted at Michigan State University, as the average daily temperature increased from 57 to 76 F (14 to 26 C), the average time from spike emergence to flowering decreased from 217 to 54 days (Table 1). This time varies somewhat by cultivar, with some flowering earlier and some a few weeks later. Based on this information and grower experience, the greenhouse temperature can be raised or lowered to finish a phalaenopsis crop for a desired flowering date.

An important component of the finishing phase involves staking and preparing phalaenopsis for an orchid show or sale. Properly staking the inflorescence will affect how the plant is presented at a show or sale, thus improving consumer appeal. In addition, staking will also minimize plant damage during packaging and transport. Plants should be staked no later than when the lowest flower bud on an inflorescence has reached the size of a marble. The stick (bamboo or other materials) used for staking should not be taller than the lowest flower bud and can be attached to the inflorescence using clips or ties. At the time of staking, plants are often sorted based on a predetermined quality grading scale (i.e., number of spikes and flowers or spike length).

POST-HARVEST When plants have at least one or two open flowers, they are ready for display or sale and can be packaged for transport. The preparation of plants for shipping and sales display is a labor-intensive process that can involve many tasks. Phalaenopsis leaves are sometimes cleaned and plants are placed into decorative ceramic or terracotta pots

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OPPOSITE TOP Staking plants is an important step during the finishing phase. Plants should be staked no later than when the lowest flower bud on an inflorescence has reached the size of a marble.

OPPOSITE ABOVE Mature plants during the cooling phase with spike initiation.

TOP Phalaenopsis placed into decorative terracotta pots and ready for shipping to a retail store.

ABOVE Three phalaenopsis plants combined into a decorative container in Japan.

Table 1. The effect of average daily temperature on the average time from visible spike to flower in several phalaenopsis hybrids grown at Michigan State University.

Temperature F (C)	Time from Visible Spike to Flower (Days)
57 (14)	217
63 (17)	140
68 (20)	97
73 (23)	71
76 (26)	54

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with sphagnum moss on the surface of the growing medium. A label with care information is often affixed to the support stick and leaf shine may be applied to the foliage before the plant is placed into a protective sleeve. Potted phalaenopsis are perceived by consumers as elegant plants with high ornamental value. As a result, all of these steps can add value to the product and influence how the plant is presented to the consumer.

Flowers of all orchids, including phalaenopsis, are extremely sensitive to low concentrations of ethylene, an odorless, colorless gas released by ripening fruits and flowers, cigarette and wood smoke and exhaust from gas heaters and combustion engines. Ethylene concentrations as low as 0.1 parts per million will cause all phalaenopsis flowers and buds to fall off within three days. To avoid ethylene damage, growers should prevent exposing plants to external sources of ethylene and also provide adequate ventilation in the greenhouse. Research at Texas A&M University showed that treating flowering phalaenopsis with anti-ethylene products such as 1-methylcyclopropene (1-MCP, or EthylBloc) at 0.2 parts per million for six hours at 77 F (25 C) protects flowers from ethylene concentrations as high as 10 parts per million. However, the duration of protection from 1-MCP is short (seven days at 77 F or 25 C) and the duration of protection declines as temperature increases. The use of 1-MCP or EthylBloc is generally limited to commercial greenhouse growers.

Hobbyists and growers have many options to produce flowering phalaenopsis orchids. Immature plants will cost less than mature ones, but will require a longer production time and additional expenses. In temperate climates, one of the largest production expenses is the energy for heating a greenhouse to promote vegetative growth. Growers who wish to reduce production time and heating costs may choose to purchase more expensive plant material that is of flowering size and can be immediately forced to flower. This option would avoid the need to grow plants at a high temperature to promote additional vegetative growth.

A simplified schedule for the production of phalaenopsis in 5-inch (12.5-cm) pots is provided in Table 2. From this, and with the information provided in our four-part series, you can develop a production schedule to fit your greenhouse conditions and produce a crop of flowering potted phalaenopsis orchids. Although this article has focused on environmental control of growth and flowering, cultural factors such as watering, fertility, pest and disease control and selection of an appropriate medium are also highly important for producing a successful and profitable crop.

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OPPOSITE Phalaenopsis carefuly wrapped for transit.

ABOVE Phalaenopsis prepared for display and sale at Nagoya Orchid Gardens in Nagoya, Japan.

Table 2. A simplified schedule for the production of flowering potted phalaenopsis orchids in 5-inch (12.5-cm) pots.

		Production Phase				
	Units	Vegetative Growth	Cooling	Finishing (to First Flower)		
Duration	Weeks	Until Plant Maturity	4 to 6	20	14	10
Temperature	F	82 to 90	63 to 77	63	68	73
	C	28 to 32	17 to 25	17	20	23
Light Intensity	Foot-Candles	500 to 1,500	1,000 to 1,500		1,000 to 1,500	
	$\mu mol \bullet m^{-2} \bullet s^{-1}$	100 to 300	200 to 300		200 to 300	