FORCING PERENNIALS

Species: Anemone hupehensis
Common Name: Anemone or Windflower

Editor's note: Michigan State University and GREENHOUSE GROWER bring you our third series on forcing perennials to flower.

Anemone is a diverse group of perennial species produced as cut flowers and potted plants. A member of the Ranunculaceae family, anemone can be divided into three categories by flowering and root morphology.

The first category includes spring-flowering anemones that have underground, knobby, tuberous, bulb-like rhizomes. The second includes those that flower in early summer and have tuberous roots. The third category, to which our recommendations apply, includes those that flower between summer and autumn and have fibrous roots (Figure 1).

Anemone flowers sit on elegant, tall shoots that emerge from the main apical meristem. After flowering, leaves and shoots die back and decompose in winter. Roots with buds that produce shoots will emerge during the following spring and summer. These shoots can flower the first year after they emerge.
1. Propagation

Root cuttings prove to be the best method of anemone propagation because shoot cuttings do not normally root. A root cutting is a propagation technique by which adventitious buds develop from roots that have been cut into individual pieces and planted upright in a growing medium. Three root cutting techniques allow efficient anemone propagation.

In the first method, mother plants are grown in open fields or one-gallon containers outside the greenhouse with full sun exposure for a summer season. In the fall, the soil is removed and the roots are cut into one-inch pieces and placed vertically in a flat or plug tray for shoot regeneration. Roots need to be kept moist until the adventitious buds form and begin to grow. Plants that develop from these buds can then be transplanted to a plug or container.

The second technique involves “scooping” the mother plant and leaving the separated single roots in place. New buds will then generate from each thick root (Figure 2). After the buds form, the shoots must be separated and transplanted while leaving the roots attached.

Removing the anemone plant from the pot and cutting the root mass and soil into one- to two-inch layers while keeping layers moist as shoots regenerate is part of the third method (Figure 3). Later, shoots are separated, leaving the roots attached, and transplanted into a plug tray.

Most references suggest the best time to take root cuttings is during late winter or early spring, before the plants develop. For proper root-bud generation, roots are placed with the top ends up because they have polarity and buds may not regenerate if they are planted upside down. Cutting the roots at the top with a straight cut and at the bottom with a slanted cut will help you place them correctly when planting.

Our experiments show that if mother plants are grown in a 68°F greenhouse, they should be at least 15 weeks old before root cuttings are taken. Because they yield more viable root cuttings, older plants with thicker roots work better. To grow a five-inch potted plant, 20 or more weeks of growth at an average daily temperature of 68°F are adequate.

Anemones also can be propagated by division, but the plants will be larger and there will be a smaller yield than crops generated by root propagation. Seed propagation is also possible,
2. Plant Maturity

Plants undergo different phases during their life cycles. During the juvenile phase, even under the proper environmental conditions, plants will not flower or respond to flower induction by cold or photoperiod. After the juvenility phase, plants can be induced to flower under proper environmental conditions.

To deliver these conditions that force plants to flower, we must know when the plants are mature. Counting the number of leaves or nodes formed after the cotyledons is one way to estimate maturity in seed-propagated plants. The number of nodes required to overcome juvenility varies from plant to plant and can be determined only through research. Some plants give natural indications of maturity by changing leaf morphology, like ivy (Hedera helix).

Using leaf counts to estimate the maturity of plants developing from root cuttings is difficult, but anemones propagated by root cuttings undergo a "reversion to juvenility" (Figure 4). Juvenile anemones initially produce juvenile leaves that have single lobes. As plants mature, subsequent leaves show signs of maturity by becoming trilobed (Figure 5). After these trilobed leaves form, plants can then be induced to flower.

3. Cold Treatment

Anemone hupehensis does not have an obligate cold requirement for flower induction, but we recommend at least six weeks at 41°F (5°C). Cold promotes more vigorous growth, in-
creases flower uniformity and numbers, and slightly reduces the time needed to flower.

The best time to deliver cold is when the plant's root system is thick and well established in a plug tray. The thicker the roots, the better. As a rule, plants with healthy, yellow roots that are more than 1/8-inch thick are ready for cold.

Plants often lose leaves during cooling, which is not a problem as long as the roots are healthy. Thick new root buds will emerge during forcing.

**4. Photoperiods**

Anemones are obligate long-day plants, so flowers will be initiated only when plants are exposed to photoperiods of at least 13 hours (Figure 6).

Long days can be provided as a day extension or a four-hour night interruption from 10 p.m. to 2 a.m. by using incandescent or high-pressure sodium lamps.

**5. Lighting And Spacing**

Crowded plants will have poor quality. Plants should be spaced according to size, allowing light to penetrate to the lower leaves. Mature plants in five- or six-inch containers require about one square foot of space each.

**6. Medium, Irrigation, And Fertilization**

Start with a well-drained medium. Proper watering is crucial for successful anemone production. When anemones become water stressed, leaf-edge burn occurs. Also, if plants are...
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Figure 6. Anemone critical photoperiod experiment showing flowering on cold-treated plants under photoperiods longer than 13 hours.

Figure 7. Lower leaf death caused by petiole breakage from plant expansion.
continuously wet, Pythium root rot develops, killing the roots and the plants.

When watering, consider the plant size, stage of development, medium, and environmental conditions like humidity, air flow, light intensity, and temperature. Large plant size, late developmental stage, low humidity, rapid air flow, high light intensity, and high temperatures generally increase water requirements.

Keep root cuttings moist, not wet, during propagation. Plug trays that are deeper than they are wide increase water runoff because of gravity. To avoid leaf-edge burn, increase watering frequency to keep roots continuously moist, but not wet, as shoots develop. Closely monitor the watering of recent transplants without established root systems.

Although plants are susceptible to leaf burn caused by water stress, it is natural for anemone to lose some lower leaves as plants age. As new leaves form, the plant’s base enlarges, breaking the lower leaf petioles and killing the leaves (Figure 7).
Figure 8. Anemone affected by Rhizoctonia. The plant can be pulled, easily separating the main shoot from the roots.

Use a balanced fertilizer to provide moderate nourishment. Constant fertilization with nitrogen at 100 to 200 ppm is adequate. The medium's pH should be kept between 5.8 and 6.4. Anemone are very susceptible to iron deficiency. We battled foliar chlorosis until we made a one-time application of 30 ppm iron from iron chelate.

7. Plant Height Control
   We have seen considerable plant height variability in our experiments, especially in the flower shoots. In our trials, the first flower opened when the plant was 13 to 16 inches (30 to 40 centimeters) tall, although plants grow considerably taller outside under good moisture. We have not tested any height-controlling growth regulators on anemone.

8. Temperatures And Crop Scheduling
   Anemone hupehensis performs best at cooler temperatures. Temperatures above 68°F (20°C) caused delayed flowering, fewer flowers, and short plants. Plants grown at 68°F (20°C) flowered in 12 to 13 weeks from the start of long-day treatments. Plants at 63°F (17°C) took 13 to 14 weeks to flower, and plants at 57°F (14°C) took around 16 weeks to flower. We suggest forcing at or below 68°F (20°C) for the highest quality plants.

9. Disease And Insect Pests
   Rhizoctonia has been our primary disease problem. The fungus attacks the plant's lower stem, causing crown rot and above-ground collapse as the water and nutrient-conducting vessels are destroyed (Figure 8). Anemone leaf stipules and petioles form a small cavity capable of collecting water, increasing the chance of Rhizoctonia infection.
   Clean stock and proper watering is essential for Rhizoctonia control, and any plant showing disease symptoms should be thrown away. When transplanting anemones into pots, soil around the shoots should be removed until the crown is exposed. This will allow the shoots to dry as quickly as possible. For Rhizoctonia control after transplanting, fungicides such as Cleary's 3336, Terraclor, Medallion, or Heritage should be applied.
   Botrytis may attack on the crown and Pythium, Fusarium, or Alternaria on the roots. Fungus gnats larvae readily attack anemone roots and can be controlled with appropriate insecticides.

About the authors: Joaquin A. Chong and Emily Clough are graduate research students, and Royal Heins, Arthur Cameron, and Will Carlson are professors, Department of Horticulture, Michigan State University, East Lansing, MI 48824.

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<tr>
<th>Table 1.</th>
<th>Anemone hupehensis Production Schedule</th>
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<tr>
<td><strong>Growing time</strong></td>
<td><strong>Cultural practice</strong></td>
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<tr>
<td>&gt; 20 weeks</td>
<td>Stock plants</td>
</tr>
<tr>
<td>12 to 15 weeks</td>
<td>Grow plants from root cuttings to mature leaves</td>
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<td>- OR - Purchase plugs</td>
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<tr>
<td>≥ six weeks</td>
<td>Cold treatment</td>
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<tr>
<td><strong>Begin Forcing</strong></td>
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<tr>
<td>64°F (17°C)</td>
<td>57°F (14°C) = 16 weeks to flower</td>
</tr>
<tr>
<td>57°F (14°C)</td>
<td>13-14 weeks to flower</td>
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