



## Tornado™

### GERANIUM PELARGONIUM PELTATUM

**Minimum Germination Rate:** 80%

**Seed Product Form:** Film coated

#### FLOWERING

**Flowering Mechanism:** Irradiance (primary); plants initiate on approximately days 20 – 24, 4 – 6 leaves present with HID light for 16-18 hours OR total 12 – 16 mols (3,500 – 4,500 ft. candles) for 3 – 4 weeks at 65° – 70°F (18° – 20°C).

**Flowering Type:** Geraniums are day-neutral plants.

**Specific Flowering Mechanism:** Light and temperature trigger flowering. Geraniums are light accumulators, the more light received, the faster the growth and earlier the flowering. DIF treatments may negate flowering.

#### PLUG CULTURE

The timing approximations are based on optimal culture recommendations below:

**Germination 1** (approximately day 1 – 4): From the time a seed is sown until radicle emergence takes place; usually with the root penetrating the media and some cotyledon development. Humidity in the air is 95 – 98% (humidification); media moisture (4+ – 5). Expect radicle emergence in 4 days.

**Cover:** Cover seeds with a thin layer of medium-sized vermiculite to maintain moisture levels.

**Media:** • pH: 6 – 6.2 Ivy Geraniums are not as sensitive to a lower pH as other Geraniums and can show signs of iron and magnesium deficiencies at a pH above 6.3; these are expressed as inter-veinal chlorosis on the new growth.

• EC: 0.75 – 1 High EC discourages rooting into the media.

**Light:** Light is not necessary for germination. If utilizing a chamber, providing a light source of 10 – 100 foot candles (100 – 1,000 lux) will improve germination and reduce stretch.

**Moisture:** Saturated (5) for day 1 – 4. On days 5 – 8 reduce to moist (3). Beginning day 9, reduce moisture further to medium (2). Geraniums have a high oxygen requirement at the root level.

**Humidity:** 100% until radicle emergence then reduce to 40%.

**Dehumidify:** Provide horizontal airflow to aid in drying down the media through evapotranspiration, allowing better penetration of oxygen to the roots.

**Temperature:** 73°F (23°C). Thermodormancy, which causes erratic germination, is induced when temperatures exceed 76°F (25°C). Temperatures below 71°F (22°C) decrease the speed and uniformity of germination.

**Germination 2** (approximately day 5 – 14): From the time cotyledon is observed until it is fully expanded. The roots have expanded throughout the media. Dehumidify from 98% to 50% moisture in the air. Media moisture during the wet cycle is usually 4 – 5, and 2 – 3 during the dry cycle; this wet-dry cycle should take place within 12 – 24 hours for most plants.

**Media:** • pH: 6 – 6.2  
• EC: 1 – 1.5

**Light:** Supplemental lighting at 350 – 450 foot candles (3,500 – 4,500 lux) for a 16 – 18-hour day will promote earlier flowering.

**Temperature:** 68° – 70°F (20° – 21°C). Gradually reduce to 65° – 70°F (18° – 20°C).

**Moisture:** Alternate between moisture levels wet (4) and medium (2). Allow media to approach level (2) before re-saturating to level (4).

**Humidity:** 40 – 70%

**Dehumidify:** Lower relative humidity to 40% (approximately day 8). Provide horizontal airflow to aid in drying down the media through evapotranspiration, allowing better penetration of oxygen to the roots.

**Fertilizers:** Alternate between calcium-based fertilizers (13-2-13 or 14-4-14) and potassium nitrate (15-5-15) at 50 – 75 ppm nitrogen. Phosphorus should not exceed 10 ppm. Geraniums are sensitive to ammonium. Ammonium levels should not exceed 5 ppm to prevent stretch.

**Gases:** Supplemental carbon dioxide can be applied at 1,000 ppm to enhance flowering under high light conditions.

**Growth Regulators:** Tornado Geraniums are naturally self branching and compact growing. If growth regulators are applied, use lower rates. Begin

applications of Cycocel (chlormequat chloride) at 300 ppm when 3 – 5 true leaves are present.

**Fungicides:** Preventative fungicide may be applied for Pythium, Rhizoctonia and Thielaviopsis.

**Plug Bulking/Flower Initiation** (approximately day 15 – 24): The time it takes for the shoots to proportionately fill the plug cell and for roots to develop throughout the media. Induction and initiation may occur; if buds are present, they should be few in number and small in size.

**Media:** • pH: 6 – 6.2  
• EC: 1 – 1.5

**Light:** Provide 3,000 – 3,500 foot candles (10 – 12 total mols or 30,000 – 35,000 lux) to hasten flower induction. Supplemental lighting under low light conditions at 350 – 450 foot candles (35,000 – 45,000 lux) will enhance shoot and root growth.

**Temperature:** 65° – 70°F (18° – 20°C). Gradually reduce to 62° – 65°F (16° – 18°C) to hold plugs.

**Moisture:** Alternate between moisture levels wet (4) and medium (2). Allow media to approach level (2) before re-saturating to level (4).

**Humidity:** 40 – 70%

**Fertilizers:** Alternate between calcium-based fertilizers (13-2-13 or 14-4-14) and potassium nitrate (15-5-15) at 75 – 100 ppm nitrogen. Phosphorus should not exceed 10 ppm.

**Growth Regulators:** If needed, spray Cycocel (chlormequat chloride) at 300 ppm.

**Fungicides:** Preventative fungicide may be applied for Pythium, Rhizoctonia and Thielaviopsis.

**Initiated Bulking** (approximately day 25 – 34): Seedlings develop from juvenile to mature, usually determined by the number of leaves present (cultivar specific). Seedlings are receptive to initiation and flower bud development.

**Light:** Provide 3,500 – 4,500 foot candles (35,000 - 45,000 lux) or 12 – 16 mols of light.

**Temperature:** 62° - 68°F (17° – 20°C)

**Fertilizer:** Alternate between calcium-based fertilizers (13-2-13 or 14-4-14) and potassium nitrate (15-5-15) at 100 – 150 ppm nitrogen. Phosphorus should not exceed 10 ppm. Under high-light conditions a 20-10-20 fertilizer can be used. Leach with fresh water every third watering.

**Fungicides:** Preventative fungicide may be applied for Pythium, Rhizoctonia and Thielaviopsis.

#### GROWING ON

The timing approximations are based on optimal culture recommendations below:

**Transplant to Finish** (approximately day 35 – 98): Optimize plant shoot and root growth; which is usually a 1:1 ratio. Flower buds are usually present and developing.

**Media:** • pH: 6 – 6.2  
• EC: 1.2 – 1.5 High salts may encourage roots to become very brittle.

**Light:** Provide 3,500 – 4,500 foot candles (15 – 20 total mols or 35,000 – 45,000 lux) to hasten flower induction. Supplemental lighting under low light conditions at 350 – 450 foot candles (35,000 – 45,000 lux) will enhance shoot and root growth. Lighting after transplant for 2 – 3 weeks, at 300 – 500 foot candles (3,000 – 5,000 lux) for 14 – 18 hours a day will induce early flowering.

**Temperature:** 60° – 65°F (16° – 18°C) nights and 70° – 75°F (21° – 24°C) days

**Moisture:** Alternate between moisture levels wet (4) and moist (3). Allow media to approach level (3) before re-saturating to level (4). Excessive drying of the media moisture level will concentrate salts around the root system and burn the root hairs. Symptoms of excessive drying include lower leaves turning reddish to yellow, and root tip die-back.

**Dehumidify:** Provide horizontal airflow to aid in drying down the media through evapotranspiration under cool, low-light conditions.

**Humidity:** 40%

**Fertilizers:** Constant liquid feed at 150 - 200 ppm nitrogen with a calcium-based fertilizer (13-2-13 or 14-4-14). Under high light conditions, a 20-10-20 fertilizer can be used. Leach with fresh water every third watering.

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## Tornado™ (continued)

**Growth Regulators:** If needed, spray Cycocel (chlormequat chloride) at 300 – 500 ppm. NOTE: Do not apply Cycocel after the buds have emerged above the foliage. Small and/or malformed flowers will result from late applications of Cycocel.

**Fungicides:** Preventative fungicide may be applied for Pythium, Rhizoctonia and Thielaviopsis.

### TECHNIQUES TO ENHANCE POST HARVEST QUALITY

**When to Treat:** 1 – 2 weeks prior to finish or shipping.

**Fertilizer:** Potassium nitrate drench at 150 ppm nitrogen.

**Common Diseases:** Pythium, Rhizoctonia and Thielaviopsis. Monitor moisture and humidity levels and use preventative fungicide drenches.

**Common Pests:** Fungus Gnats, Shore Flies and Thrips. Use pesticides according to label directions.

PRODUCT USE	GARDEN SPECIFICATIONS
Pots, containers, mass plantings	<b>Light:</b> Part to full sun <b>USDA Hardiness Zone:</b> 10 <b>AHS Heat Zone:</b> 12 – 1

	Garden Height	Garden Width
<b>Tornado</b>	8 – 10" (20 – 25 cm)	12 – 14" (30 – 35 cm)

### GERANIUM SCHEDULING IN WEEKS:

	Tornado
<b>Total crop time</b>	12 – 16
<b>'128' plug crop time</b>	7 – 8
<b>'200' plug crop time</b>	6 – 7
<b>'288' plug crop time</b>	5 – 6
<b>Transplant to finish crop time from a '288' plug</b>	
<b>4" crop</b>	8 – 9
<b>6" crop</b>	9 – 10, depending on number of plugs transplanted
<b>8" crop</b>	9 – 10, depending on number of plugs transplanted
<b>8" basket crop</b>	10 – 11, depending on number of plugs transplanted

The shortest crops times may be achieved when following recommended optimal culture. Deviation in environmental conditions will result in longer crop times.

*Note: These suggestions are only guidelines and may have to be altered to meet individual grower's needs. Check all chemical labels to verify registration for use in your region.*