Green Leaf Plants®

Technical Guide
COOLING & FORCING KEEPSAKE® AZALEAS

Dormant Keepsake Azaleas

To reliably cool and flower dormant azalea plants with reasonable uniformity, the following procedures should be followed:

RECOMMENDATIONS FOR REFRIGERATED COOLING

In-Box Cooling Procedure

This is a well proven process, and should replace the old standard procedure for cooling dormant azaleas. The technique allows cooling dormant azaleas on receipt, without removing them from the shipping box or watering them during the four-week (28 days) cooling process required to break dormancy. The benefits are obvious and it works quite well if you can reliably provide these basic requirements!

1. Cool for four weeks.
2. Maintain a temperature of 38°F-40°F, 24 hours a day.
3. Provide a humidity level of 90% plus. This is still an essential requirement even though cooling is done in the shipping box.
4. Put the boxes into the cooler immediately on receipt.
5. When stacking boxes, allow at least 1" between stacks for cool, humid air circulation.

Should you occasionally get a lightweight box, indicating media is dry, remove the plants, water the media thoroughly (not foliage), replace the plants, close the box, and put them in the cooler.

Cooling

Cooling refers to the period required to break the dormancy of an azalea in a refrigerated cooler.

Critical Points:

1. Maintain cooler temperature of 38° to 40°F.
2. Maintain over 90% relative humidity in the cooler.
3. Cool for 4 weeks.

Old Standard Cooling Procedure

This prcedure is no longer necessary, but for those who wish to continue, here is the process.

If plants arrive on a weekend or at night and cannot be unpacked immediately, boxes should be placed in a cooler at 38° to 40°F.

Temperature - 38° to 40°F maintained 24 hours a day. A temperature recorder or hygrothermograph is a requirement for monitoring the temperature and humidity.

Humidity - over 90%. By keeping the floor wet continuously by hand watering, or the use of a drip system on a humidistat or timer, humidity can be maintained at this level. **The floor must be wet at all times to maintain the desired humidity (90% plus)!**

Watering - Check plants weekly but water only if they need it. Need should be measured by the weight of the pot, and not by touching the media. Lightweight pots need water. Featherweight pots are well past the need for watering. Maintaining the proper humidity minimizes the need for irrigation. A good rule of thumb: normally only one irrigation in the cooler is needed in a four-week period. It is most often needed after the first week of cooling. If pots are drying out and require more than this, then temperature, humidity or air movement is out of balance.

Air movement off the cooling coils should be low enough in velocity, or so directed that there is no movement of the foliage on any plants. Roots, at these temperatures, take up water very slowly so dehydration can occur causing leaf burn if air movement is excessive.

Air exchange is a requirement for coolers to avoid build-up of ethylene or other gases. An optimal air change is once every 4 hours. A simple solution is to install an exhaust fan on a timer. If the cooler is not vented, the cooler door can be left open for 10 minutes, 3 times per day, to insure exchange of air. However, in high-temperature periods, it may be impossible for your cooler to hold the required temperature by opening the door.

Cooling time is four weeks (28 days).

Spacing in the cooler can be as close as 7 x 7 for a 6” pot as long as the foliage is dry when pots are put in the cooler.

Buds Showing Color On Receipt Of Dormant Azaleas

Occasionally plants will be received with buds cracking color. While it is not an annual occurrence, it can

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occur with shipments for the spring Easter and Mother's Day flowerings. It also can vary from year to year depending on the weather in south Florida.

If, during the late stages of bud development, a period of cold temperature is followed by a period of warm temperature, some buds can break dormancy and begin to open earlier than normal.

When early color occurs, it is almost always seen in Prize. Remembrance and Party Favor can also be affected.

Critical Point:
The best way to handle these plants is to follow the prescribed routine and IMMEDIATELY put dormant plants in the cooler to break dormancy on the other buds, and to IMMEDIATELY put Ready To Force (RTF) plants on the bench to begin forcing.

It may be necessary to break out a few of the advanced flowers in the bud cluster during forcing. If flowering appears to be too early, lower temperatures in the forcing area to slow it down. As with other crops coming in early (lilies, pot mums, etc.), move them into a cold house or refrigerated cooler when bud development is between buds showing color and the candle stage.

It is better to do the normal steps in cooling and forcing to even out the flowering across the head as much as possible before placing in a refrigerated holding cooler.

Ready-to-Force Keepsake Azaleas

Critical Point:
Whether the plants are coming out of your cooler after breaking dormancy or are ready to force after coming off the truck, you should do the following.

Acclimation

Root balls should be warmed up before the plants go to the forcing area. Two suggestions for accomplishing this are: (a) Remove dormant plants from the cooler the **night before** forcing begins (not during the heat of late afternoon). Water thoroughly and place the plants in a shaded service area at prevailing air temperatures, then onto the bench early in the morning. (b) Remove plants from the cooler early in the early morning and place on the forcing bench. Immediatly water thoroughly until you get a good run through, and water is freely coming out of the bottom of the pot.

Warming root balls and maintaining light levels at 3,000 footcandles or lower for the first 2 to 4 days will reduce the incidence of leaf burn. Misting the plants during the heat of the day for the first 2 to 4 days will provide an even greater reduction. Misting needs will vary from forcing area to forcing area, therefore, keep in mind the objective is to keep a thin layer of water on the foliage during the heat of the day to further prevent moisture stress and reduce burn. Misting intensity should be more frequent at the start of the mist period and more delayed toward the end of the mist period; i.e. 2 days frequent mist and 2 days delayed mist. We do not recommend misting beyond 4 days, as this will invite the incidence of foliar diseases.

This is basically a water stress issue. All varieties can be affected during the high light and higher temperature periods of late spring through early fall.

Buds Showing Color See above, **Buds Showing Color on Receipt of Dormant Azaleas**

Forcing Dormant and Ready-to-Force Keepsake Azaleas

Forcing

Forcing is the period from removal from the cooler until the plant is sold as a flowered plant.

Critical Points:
1. Light levels of 2,500 to 4,000 footcandles during forcing.
2. Fertilize with 50 PPM N one time per week during forcing.
3. Allow adequate space in forcing.
4. Use Gib.
5. Do not overwater.
6. Maintain a maxium day temperature of 90°F, and a minimum night temperature of 65°F.

Forcing Time
Keepsake Azaleas require 3 to 6 weeks to force. Four to 5 weeks is a good average most of the year with adequate light, temperature and variety selection. **Forcing time varies by the forcing environment, season and variety.**

Environment: 2,500 footcandles minimum and 4,000 footcandles maximum is optimum. Light levels below 2,500 footcandles in winter increase forcing time and uneven flowering. Northern growers with low-light intensities in winter, particularly for the Christmas through Valentine's Day flowering period, can require 6 to 7 weeks. Temperatures below 65°F will also extend forcing time. During the winter months under old glass or fiberglass, light reduction should not be necessary, particularly in northern areas unless the above footcandle levels are regularly exceeded.

In northern low-light conditions, clean glass is a "must" to develop all flowers and have uniform flowering. Light levels below 2,500 foot-candles will greatly reduce the uniformity of flowering and increase forcing time. Remove shading compound by November 1. Shading

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compound should not be re-applied until April 1 in most locations.

Season: Forcing is fastest in spring (natural flowering time for an azalea) and gradually slows through summer, fall and early winter before gradually speeding up again going into spring. December is usually the transition point where a gradual speed up begins, if good light is available.

Varieties: Under good light conditions, varieties can generally be classified in two groups: Fast and Regular, which are 3 to 5 days apart. Under northern conditions with lower light intensities, the two groups are more likely to flower 5 to 7 days apart. (see chart below)

Most growers have all varieties come in on one shipment. On a week-to-week program, that works well because you soon get the fast varieties in sync with the regular varieties from an earlier shipment. However, it's wise to keep these differences in mind when planning for holidays. Be prepared to put early material in the cooler, or schedule multiple shipments for a holiday by shipping early varieties a week later.

It is highly unlikely to see all varieties on a shipment flower at the same time, but you can come close by staying within a group if the variety mix can fill your needs.

Forcing Area

Temperature: Maintain a minimum of 65°F night temperature and maximum of 90°F day temperature; fan set point (if using fans and pads) is 80°F. Fan and pad cooling during high-temperature periods improves the uniformity of the crop.

Light intensity: Maintain a maximum of 3,500 to 4,000 footcandles. Above this level petal burn can result, particularly on darker colored varieties. A minimum of 2,500 footcandles is desirable. Levels below this are not uncommon during Northern winters, so keep in mind it will increase forcing time and uneven flowering, and allow for it on your forcing schedule.

Ventilation: Provide adequate ventilation to avoid condensation on foliage. Foliage should not be wet going into the night. This is mainly of concern in houses where multiple crops are grown and fans are turned off at night and/or vents are closed.

Water Management: Soil must never dry out nor should the plants be allowed to wilt. This causes uneven flowering and brown buds. Damage can be done, even if the foliage is not visibly wilted. Certainly it should be considered a given that inadequate irrigation during forcing, or the other extreme of over watering to the point that root hairs are killed, will definitely contribute to water stress. Keep in mind that our media, Coir, does not require as much irrigation as peat moss. Water

Forcing Ratings

Under lower light late fall, winter and early spring conditions in the North, groups flower 5 to 7 days apart. Under higher light conditions the two groups flower closer together.

FAST-FORCING VARIETIES

RED	PINK	LAVENDER	ORANGE/CORAL
Scarlet (USPP #13073) – Red	Party Favor (USPP #10050) – Pink	Emblem (USPPAF) – Lavender	Bittersweet (USPP #16526) – Orange
	Remembrance (USPP #9123) – Dark Pink	Provence (USPP #18947) – Lavender	Ornament (USPP #12963) – Dark Coral Rose
			Rozalea® Coral (USPP #18951) – Coral

REGULAR-FORCING VARIETIES

PINK	PURPLE	CORAL	WHITE	BICOLOR
Diva (USPPAF) – Pink	Majesty (USPPAF) - Purple	Rozalea® Coral Pink (USPP #16499) – Coral Pink	Honesty (USPP #12054) – White	Tiffany (USPPAF) – White and Pink
Rozalea® Dark Pink (USPPAF) – Pink			Rozalea® White (USPPAF) – White	
Rozalea® Pink (USPPAF) – Pink				

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should have a soluble salts reading no higher than 0.60 mmhos/cm. Higher levels will result in decreased keeping quality of the flowered plant.

Irrigation And Fertilization

It has been well known **there is a benefit to very light fertilizations during forcing if used in moderation.**

The old cliché, "Some is good, more is better," has gotten some customers into trouble, and made us reluctant to recommend fertilization during forcing. We are changing that position because new varieties are stronger, more vigorous growers and light fertilization greens up all foliage, and helps minimize lower foliage loss.

Our recommendation, starting with the third day of forcing, is to apply **150 ppm of N from a complete N-P-K fertilizer once a week** until sale. Use 10 ounces of 20-20-20 per 100 gallons, or 10 ounces of 20-20-20 per gallon of concentrate through a 1:100 injector, for 150 ppm nitrogen.

This is not a rate commonly used for other crops. Growers have gotten into difficulty, burning roots, when they attempt to use higher rates already in use in their operation. Again, more is not better in this case.

Dry Foliage and Flowers: Plants should not be watered at a time when it will cause them to go into the night, or into the shipping box or cooler, with wet flower buds or foliage.

Overhead or "Spaghetti" Tubes: Are acceptable methods. With tube systems, it is necessary to check the tubes frequently to ensure that ALL plants are being watered properly, and the media in all pots is thoroughly wet.

Trough Systems: Have a history of developing high salts problems. If troughs are used, it is recommended they only be used the last 1 to 2 weeks of forcing with overhead irrigation being used initially. This will prevent any salt buildup problems.

Spacing: Minimum spacing of 12 x 12 per 6" plant and 8" x 8" for 4½" pots. Plants must not be crowded because uneven flowering and brown buds will result if branches overlap. It may also set the stage for Botrytis.

Raised Benches: Allow air circulation around the plant material and facilitate easy removal of bypass shoots.

Bypass Removal: These should be removed at least once a week if it develops. Delayed bypass removal can cause bud abortion, or delayed and uneven flowering.

Use of Gibberellic Acid

(GIB - Pronounced "Jib")

Foliage sprays of Gib do speed up forcing time, but only by a couple of days. The main value of Gib is to help provide a more uniform flowering across the pot; so more flowers are open at one time. It works year-round, but its greatest benefit is from early summer through early winter, the furthest point in time from natural flowering.

There is also a distinct relationship between forcing time and the number of spray applications of Gib required. Regular-forcing varieties require more applications than faster-forcing varieties. So in the fall, for example, Honesty will require more spray applications than Prize. (See chart for forcing ratings.)

Applications are on the 3rd, 10th and 17th day of forcing if needed. In late summer and fall.

All varieties benefit from at least one application at all times of the year. A second or third application may be needed depending on the time of year. Normally one application is needed in spring and three in late fall/early winter. Two applications will normally suffice in the interim seasons. Since repeat applications are varietal, keep the plants of each variety together. On the 10th day of forcing, if there is uniform bud swelling across the plot of a variety (especially the smaller buds in the center of the crown) an additional application is not necessary. If not, spray and repeat the review by variety on the 17th day.

Apply a 500 ppm Gibberellic Acid spray evenly to all foliage. Gib does not translocate in the plant so it's important to cover the entire plant. Concentrate on spraying the smaller green buds, normally found in the center of the plant. They benefit the most because you are trying to "catch them up" with the bigger buds normally found around the perimeter of the crown.

Gib Products

Use 2 ounces of a product which contains 4% Gibberellic Acid per 1 gallon of water to prepare a 500 ppm spray solution. **The product currently labeled for use on azaleas is ProGib T&O.** It is manufactured by Valent and is distributed via standard greenhouse/nursery supply companies. ProGib T&O is a liquid solution that contains 1 gram Gibberellic Acid per ounce. Use 2 ounces in 1 gallon of water to prepare a 500 ppm spray.

Before using any material, be sure that it is registered for use in your state. Check with your local county extension agent or state university extension service. See label for use rates and application methods. Always follow label directions.

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Post Harvest Handling of Flowered Plants

Critical Points:
1. Sell at the proper stage of development (10-15 buds at candle-stage).
2. Keep root media moist but avoid sitting in water.
3. Acclimate plants that have been cooled prior to retail sale.

Bud Development
Research has shown that plants sold with buds just cracking color will not develop normally (light color, small). Few, if any, of the buds not showing color will open under the low-light environment of a retail outlet or home. Plants shipped to customers without greenhouse facilities should be shipped with 10-15 buds in the candle stage for maximum keeping quality and overall display.

Soil Moisture
Azalea keeping quality is dramatically reduced by any stress on the root system. High salts and excessive drying are the primary causes of reduced keeping quality. Plants should be watered thoroughly before going into the cooler to insure a moist soil ball at shipping. Foliage and flowers must be free of water before going into a shipping box or cooler. Customers should be instructed to water the plant upon receipt to condition the root ball temperature and minimize wilting.

Holding Cooler
Plants should be placed in the cooler when bud development is between buds showing color and the candle stage, and the bud count meets the minimum you require. The cooler should be 38° to 40°F. Flowered plants should not be held for longer than seven days in this cooler.

Handling During the Summer
Moving flowered plants from a cold environment (40° to 45°F) to a hot one (90° to 100°F), such as a greenhouse or a packing shed, will result in breakdown of the flowers. Symptoms are a marginal browning of the petals or large, light brown or white, necrotic area on the petals. This can be prevented by gradually warming the plants up to the hot environment overnight, and watering the root balls thoroughly to activate the roots at the time of movement from the cooler. The plant is unable to take up sufficient water to prevent desiccation under the extremely hot conditions if the roots are not activated.

Avoid leaving boxes of packed plants sitting in hot areas. Damage can be seen within 2 to 3 hours of exposure.

An Alternative to Refrigerated Cooling: Natural Cooling

Critical Points:
1. Maximum light intensity of 2,500 footcandles.
2. Timing is more variable since conditions are variable.

This method requires the use of a cold greenhouse to provide the necessary temperatures to break the dormancy of the buds.
Temperature: 35° night time to 50°F day time
Light Intensity: Maximum intensity 2,500 footcandles.

Advantages: No cooler required.

Disadvantages: Can only be used during the time of the year in northern climates when outside temperatures allow the greenhouse to maintain the temperatures required for cooling. Recommended for Valentine's Day through Mother's Day flowerings depending on the location. Remember, over a 24-hour period (24/7), one does not have the same control of temperature and light intensity as in a refrigerated cooler. Cold temperatures and a very bright day may cause leaf discoloration, foliage drop or bud damage because the cold plant cannot pump water to the top of the plant as required.

Since temperatures normally vary over a 24-hour period, forcing may take 1 to 2 weeks longer. Timing varieties is more difficult because conditions are variable.

Insects and Disease

Thrips Are Main Concern

When spring is right around the corner, so are thrips. Spring is the time to start looking for thrips and to be prepared. It is far less costly to prevent damage than to react once damage occurs. Our experience shows that thrips will attack buds as soon as color shows, or even when the buds first crack the shell. Here are some suggestions to help you prepare for thrips before they arrive.

Critical Points For Thrip Control:
1. Use sticky cards and sample plants to monitor thrips presence.
2. Keep weeds out of greenhouses or nearby areas.
3. Spray plants thoroughly every 2 days when thrips pressure is high, and twice a week under routine conditions.
4. White varieties are good indicators.

Monitoring
Because of their small size, the presence of thrips usually goes unnoticed until their damage begins to appear on the crop. At this point control becomes even more difficult and is often not achievable. In order to minimize this risk, it is important to determine if and to what degree thrips are present in the greenhouse or growing area before the crop

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begins to flower or prior to moving a flowering crop into that area.

Yellow Cards
The use of yellow sticky cards is an excellent tool for monitoring thrips and other pest populations. The number of yellow cards you use will vary depending upon the size of your greenhouse and the number of crops that you grow. These cards should be placed at least one every 10,000 square feet just above crop height. If the greenhouse contains more than one crop, then a yellow card for each crop is suggested. They can also be placed near doorways and cooling pads to help monitor these likely entry zones. Ideally, it would be best to check and replace these cards three times a week. Using them in this manner will enable you to react to an influx of thrips more quickly, as well as help you evaluate the effectiveness of your spray program. At the very least, sticky cards should be read and changed once per week.

Blue sticky cards can also be used to help monitor for thrips. Research has shown that thrips are slightly more attracted to this color. However, the yellow card remains a more versatile monitoring tool and is quite effective in attracting most flying greenhouse pests.

Sampling
Plants and flowers already in place in the greenhouse can be checked for thrips by physically shaking them over a piece of paper. White paper is most commonly used when checking for adult thrips, while black paper shows younger stages more easily. A small 20x hand lens will be helpful when inspecting these finds.

Control Options
Eliminate or reduce weeds within and adjacent to the greenhouse. Weeds are notorious for harboring thrips, mites, aphids and viruses – and could be the overwintering host and source of the problem. During periods of high pressure or when infestations are detected, sprays should be applied every three to four days. This interval can be reduced to once every five days when populations are moderate and once every seven days when populations are low and no protection is needed.

With the exception of granular products, thorough coverage is essential for any chemical to be effective. Check the nozzles on the spray equipment to determine if you are getting good coverage, keeping in mind that spray penetration into the flower once it begins to open is critical.

Pesticides recommended for controlling thrips on Keepsake® Azaleas. Aris has found the following sprays to be safe and effective, although some resistance may be developing on Conserve. All can be sprayed on open flowers.
Ardent • Azatin • Conserve
Decathlon • Pylon • Safari
Tristar

During routine low thrip pressure periods, you can use several of these **in rotation**, such as Decathlon, Azatin and Pylon, or Decathlon, Azatin and Tristar, and spray twice a week.

During high pressure periods, we have found **a rotation** of all of the seven pesticides above, applied every two days, provides good results.

It is important to read the label and consult your extension agent for your state's regulations before spraying any pesticide. Be certain that any chemical used is properly labeled for use in your area and obtain proper application rates. Always follow label directions.

Disease Control

There are few disease problems on Keepsake Azaleas. Avoid overwatering to prevent root rot. Botrytis blight can be a problem. Botrytis is usually associated with several days of wetness such as wet plants in a cooler or plants packed wet or plants getting wet two or three times or more in a day. The very best "fungicide" for botrytis is "air and dry" - give the plants some space so the air can get to them and the foliage can dry out.

Critical Points For Botrytis Control:
1. Practice thorough sanitation in the greenhouse.
2. Avoid injury to plants.
3. Prevent high-humidity conditions.
4. Establish well-spaced plants, good ventilation, and reduce overhead water.
5. Be sure foliage is dry before putting plants in coolers to break dormancy.
6. During forcing, don't let foliage remain wet overnight.
7. Avoid excessive nitrogen.

Chemical Control Options for Botrytis:
Spray Daconil Ultrex flowable to run-off. Repeat on a 7 to 14 day schedule. Phytotoxicity can be a problem, so use on a small scale to determine if safe. Or spray Medallion to run-off. Repeat on a 7 to 14 day schedule.

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