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A Beginner's Guide to Begonias: Hybridization and the Gateway to a New World in Its Breeding[1]

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Introduction

Begonia spp., the fifth-largest genus of flowering plants with over 2,000 species and hybrids (Hughes et al. 2015; Tian et al. 2018), is highly popular in North America, especially in Florida, Georgia, Hawaii, and Puerto Rico. Begonia is pantropical, with multiple centers of origin and diversity. Major centers occur in the Andean Neotropics, across Southeast Asia (particularly in Malaysia), and in tropical Africa and Madagascar (Moonlight et al. 2018). These patterns reflect repeated spread in humid mountain and lowland forests (Thomas et al. 2012). Florida plays a key role in begonia cultivation due to its warm climate, long growing seasons, and strong horticultural industry. These ideal conditions make Florida a hub for begonia production, with begonias contributing significantly to the state's ornamental plant market.

Intended Audience and Purpose Statement

This guide is designed for horticultural professionals, advanced hobbyist gardeners, plant breeders, and academic researchers interested in begonia hybridization. Whether readers are commercial growers seeking to develop new marketable varieties, a university student studying plant breeding, or an experienced gardener looking to expand their hybridization skills, this publication provides both theoretical foundations and practical applications for successful begonia breeding programs.

The primary purpose of this guide is to bridge the gap between scientific breeding principles and hands-on hybridization techniques, providing readers with a comprehensive resource for creating novel begonia varieties that exhibit improved ornamental value, environmental resilience, and commercial viability. By combining genetic understanding with practical methodologies developed at UF/IFAS research facilities, this publication aims to advance the field of begonia breeding and inspire innovation in ornamental horticulture.

1. Understanding *Begonia* Genetics

Hybridizing begonias allows gardeners to create new varieties with distinctive traits, including striking foliage patterns, vibrant colors, and improved hardiness. For example, *Begonia rex* is known for its intricate leaf patterns, with red and purple hues influenced by dominant genes, while traits like leaf size may be controlled by recessive genes (Dewitte et al. 2011) (Figure 1). A basic understanding of *Begonia* genetics is important for breeders because these plants exhibit a wide range of traits in both their leaves and flowers.

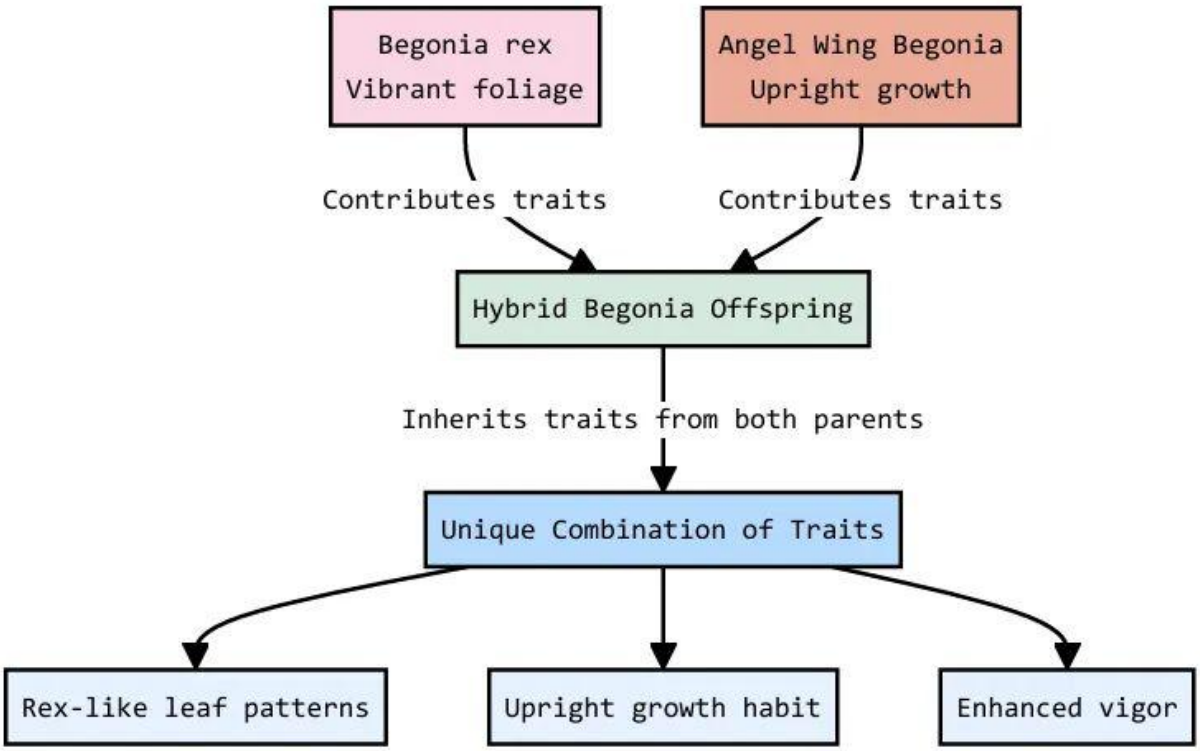

Figure 1. Begonia Hybridization Process.
Credit: Tao Jiang, UF/IFAS

2. Selecting Parent Plants

The success of any hybridization project relies on selecting the right parent plants. It is important to choose plants with desirable traits that complement each other when crossed. Key traits to consider include unique leaf shapes, patterns, and plant architecture (Figure 2); vibrant flower coloration (Figure 3); high-temperature resistance (Figure 4); drought tolerance (Figure 5); and disease resistance (Figure 6). However, it is equally important to account for critical factors such as genetic relationships and background. Wide hybridization, such as crossing begonias from different groups or origins, often encounters barriers, for instance, crossing semperflorens with rhizomatous begonias as they have different chromosome numbers (Legro and Doorenbos 1969). These barriers will lead to low success in crossing. Hybridizers often prioritize rex and rhizomatous begonias for their ability to pass on distinctive leaf shapes and vibrant foliage. Angel Wing begonias, known for their upright growth, can enhance structural strength, while semperflorens begonias are valued for their nonstop colorful blooms. Tuberous begonias, which have rose-like flowers, along with thick-stemmed, rhizomatous, semperflorens, and cane-like varieties, are also favored for their heat and drought resistance.

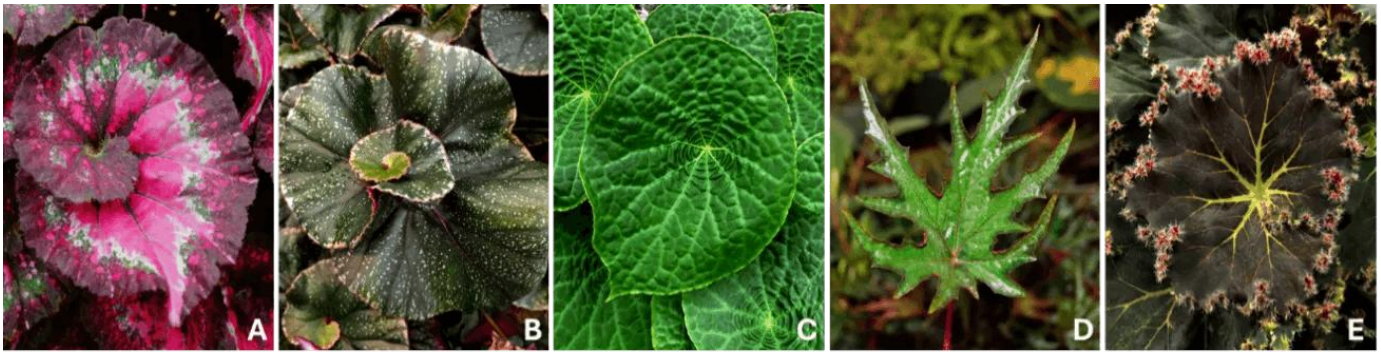

Figure 2. Typical *Begonia* species with unique leaf shape/pattern and plant architecture: the colorful and spiral leaves of (A) *Begonia rex* 'Marion's Purple Curl' and (B) *Begonia* 'Jelly Roll Morton'; (C) round peltate leaves of *B. natunaensis*; (D) palmate or star-shaped leaves of *Begonia* U614; and (E) lettuce-like leaves of *Begonia* 'La Cresta'.
Credit: Used with permission from Steve's Leaves

Figure 3. Typical *Begonia* species with vibrant flower colors: (A) pink winter-flowering and tuberous *B. socotrana*; (B) yellow flowering and tuberous *B. pearcei*; (C) orange-flowering and tuberous B. *boliviensis*; (D) orange flowering and cane-like *B. dichroa*; and (E) pink-flowering *Begonia* 'Cocktail Vodka'.
Credit: Used with permission from (A) Steve's Leaves and (B) Begonian Express; (C–E) Wisnu Ardi, UF/IFAS

Figure 4. Typical *Begonia* species and cultivars with heat resistance: (A) the cane-like, Sulawesi endemic species *B. hooveriana*; (B) *Begonia* FB08-163; (C) UF advanced line *Begonia* UF183-11; (D) the star-shaped leaf and rhizomatous *B. heracleifolia*; and (E) the rhizomatous hybrid *Begonia* 'Tranquility'.
Credit: Wisnu Ardi, UF/IFAS

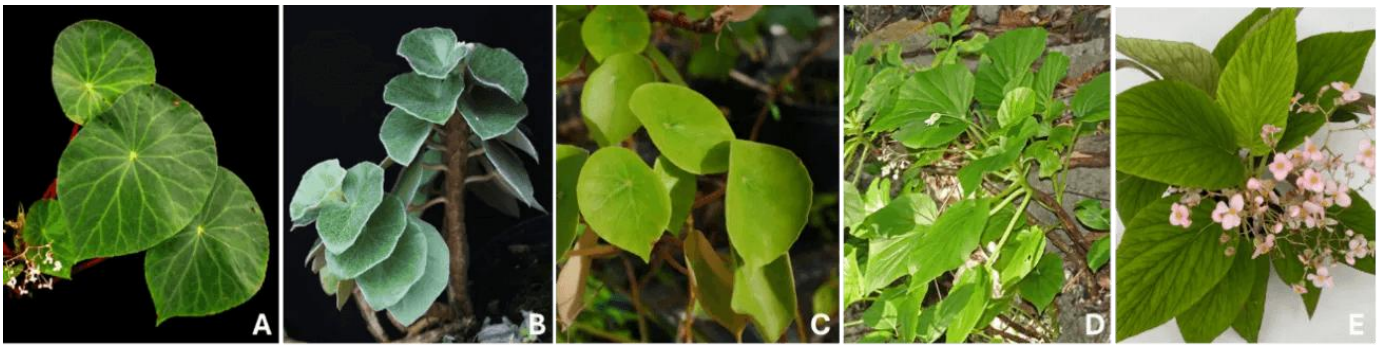

Figure 5. Typical *Begonia* species with drought resistance: the (A) Sumatra endemic species with peltate leaves *B. kudoensis*; (B) thick-stemmed, Brazilian endemic *B. venosa*; (C) Brazilian endemic species *B. goldingiana*; (D) Philippine endemic species *B. elnidoensis*; and (E) Philippine endemic species *B. wadei*.
Credit: (A–C) Wisnu Ardi, UF/IFAS; Used with permission from (D) Raab Bustamante, Co's Digital Flora of the Phillippines, and (E) Steve's Leaves

Figure 6. Typical *Begonia* species with disease resistance: the (A) rhizomatous hybrid *Begonia* 'Steve's Leaves Baltic Amber'; (B) hardy species *Begonia grandis*; (C) UF advanced line UF183-11; (D) UF advanced line UF15B; and (E) wild type of Semperflorens, *B. cucullata*.
Credit: Used with permission from (A) Steve's Leaves; (B–E) Wisnu Ardi, UF/IFAS

3. Using Pollination Techniques for Hybridization

Pollinating begonias is a key step in creating hybrids. Since begonias have separate male and female flowers, pollination involves transferring pollen from the male flower to the female flower on a different plant (Figure 7), following the protocol outlined by Ginori et al. (2022). To avoid unwanted cross-pollination, isolate flowers or cover them with bags. This ensures that only the selected plants are involved in the cross.

Figure 7. Hand pollination of begonia flowers involves the delicate manipulation of floral parts to transfer pollen for breeding or hybridization purposes.
Credit: Wisnu Ardi, UF/IFAS

4. Growing and Evaluating Hybrids

After pollination, collect the seeds and grow them into seedlings. As the hybrids develop, observe which traits have been passed on from the parent plants. Some hybrids may resemble one parent more, while others show a mix of traits. Look for changes in foliage color, shape, and texture, as well as growth habits like upright or trailing forms. Also, hybrids should be assessed for heat tolerance, drought resistance, and pest or disease resistance.

The first generation of hybrids (F1) may not always show all the desired traits, so you might need multiple generations of selective breeding to achieve stable, ideal characteristics.

Practical Application in Our Greenhouse

Our greenhouse at the UF/IFAS Mid-Florida Research and Education Center (UF/IFAS-MREC) holds significant potential for begonia hybridization collection by showcasing several successful breeding lines.

For instance, in 2021, we developed a heat-resistant line of semperflorens begonia (*Begonia* UF183-11) by crossing a wild type, OPGC5104, with *Begonia* 'Cocktail Vodka', a commercial variety known for its glossy bronze leaves and bright red flowers. This line demonstrated superior performance during the hot Florida summer in a trial conducted from June through August 2024 (Figure 8).

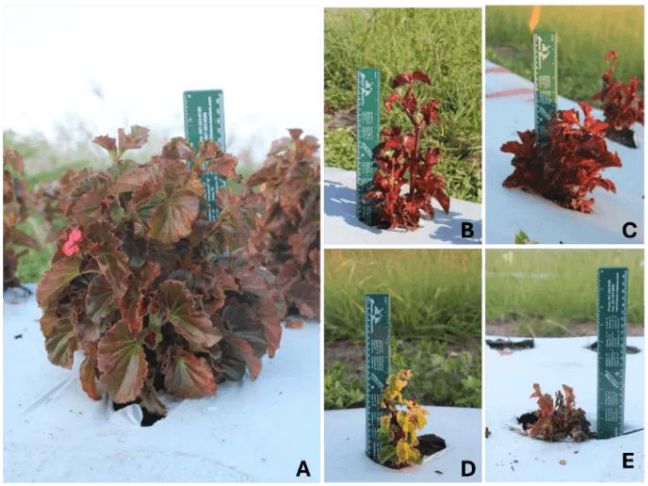

Figure 8. Field performance of UF advanced line semperflorens *Begonia*, UF183-11, crossed with the following commercial varieties after a 50-day trial test: (A) *Begonia* UF183-11; (B) *Begonia* UF5B; (C) *Begonia* 'Cocktail Vodka'; (D) *Begonia* 'Cocktail Whiskey'; and (E) *Begonia* 'Bada Boom Scarlet'.
Credit: Wisnu Ardi, UF/IFAS

Another example involves rhizomatous begonias, where *Begonia* 'Tranquility', a cultivar having deep blue-green leaves speckled with burgundy, was crossed with *Begonia* 'Autumn Amber', a cultivar that has striking orange foliage. The resulting hybrids combined the best traits of both parents, creating a beautiful blend of leaf shape and color (Figure 9).

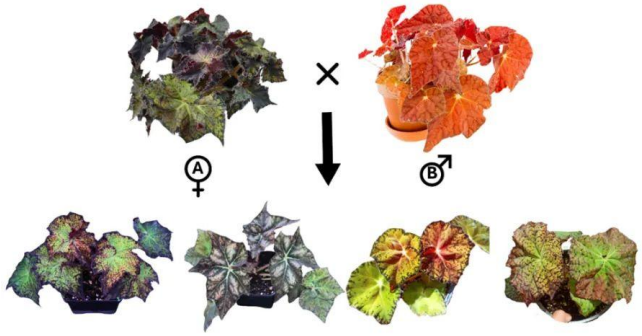

Figure 9. Crossing between (A) *Begonia* 'Tranquility' and (B) 'Autumn Amber' and the resulting four selected individuals.
Credit: Wisnu Ardi, UF/IFAS

A historically successful breeding effort dates to 1891, when French breeder Victor Lemoine crossed *B. boliviensis*, a tuberous species, with *B. dregei* to create *Begonia* 'Gloire de Lorraine'. This hybrid was classified as ×*cheimantha*, meaning "winter flowering" in Latin, and has since served as a foundation for improving winter-blooming traits (Doorenbos and Legro 1968).

Common Challenges in Hybridizing Begonias

Hybridizing begonias presents various challenges. A major issue is trait stability, as some hybrids may revert to one parent's traits over time. For example, crossing *Begonia* 'Lady Francis' with UF183-11 to achieve heat tolerance and double flowers resulted in weak hybrids that failed to retain these desired traits (Figure 10).

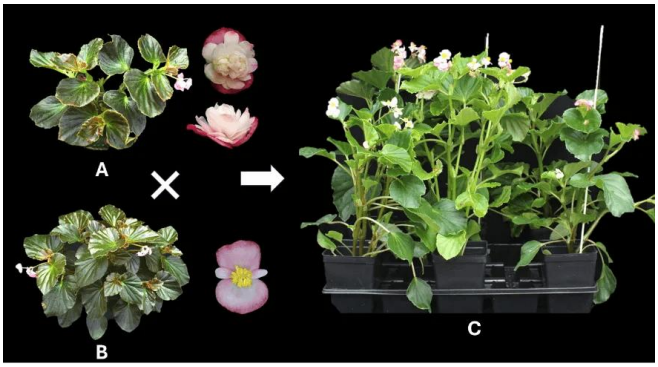

Figure 10. Crossing between two varieties of wax begonia, (A) *Begonia* 'Lady Francis' as the female parent and (B) *Begonia* UF183-11 as the male parent, with (C) their resulting seedlings.
Credit: Wisnu Ardi, UF/IFAS

Another limitation lies in low fertility. Some crosses yield few or non-viable seeds due to genetic incompatibility. For example, crossing *Begonia* FB08-163 with UF183-11 resulted in empty seeds, a typical issue when attempting to hybridize genetically distant plants (Figure 11).

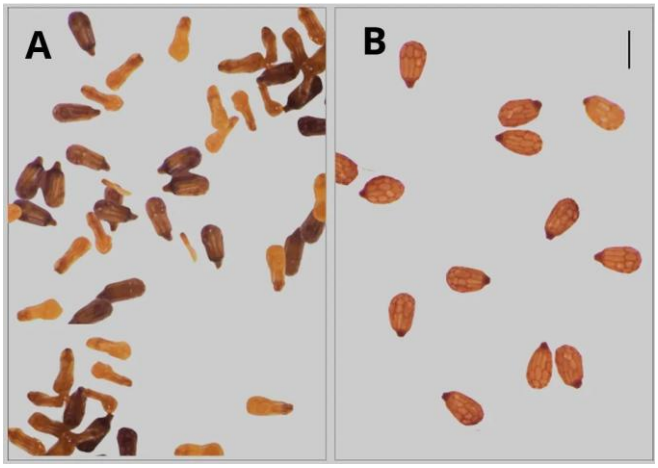

Figure 11. (A) Empty seeds resulting from the cross between Begonia FB08-163 and UF183-11. (B) Well-developed seeds from crossing Begonia UF183-11 and UF5B.
Credit: Wisnu Ardi, UF/IFAS

Propagation efficiency and seed production are also limiting factors, as producing large quantities of certain hybrids, especially those with unique traits, can be challenging. Additionally, performance variability across different growth conditions remains an area for future exploration to optimize growth environments and commercial viability. Despite these obstacles, hybridizing is a blend of art and science, and breeders continue to refine techniques to create resilient and visually appealing begonias.

Conclusion

Hybridizing begonias is a rewarding process that allows you to develop new varieties with unique and appealing traits. By understanding basic genetics, selecting the right parent plants, and using proper pollination techniques, gardeners can create begonias that are not only beautiful but also more resilient and better suited to their environment. Whether aiming for vibrant foliage, compact growth, or disease resistance, begonia enthusiasts can find limitless possibilities through hybridization.

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