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Evaluating Remontancy and Rebloom in *Hydrangea macrophylla*

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Summary

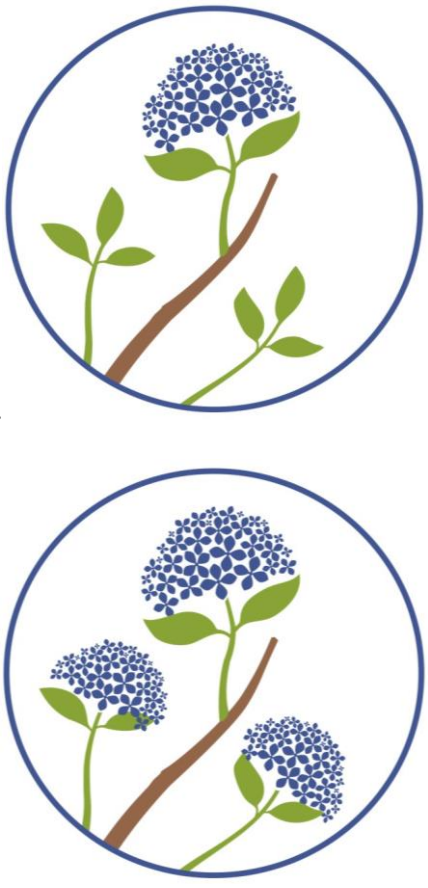
In *Hydrangea macrophylla*, remontancy is a valuable trait that is relatively easy to incorporate into seedling lines, but determining which lines possess the strongest rebloom can be more challenging. Simply falling into the classification of "remontant" does not necessarily mean a hydrangea will be a strong rebloomer. Plant breeders at Bailey Innovations™ gauge hydrangea rebloom potential through seasonal cutback evaluations and annual rebloom trials. This paper details the procedures and protocols utilized by Bailey Innovations™, to evaluate selections of --*Hydrangea macrophylla* which have superior reblooming characteristics.

INTRODUCTION

Located in Winterville, GA., Bailey Innovations™ is the in-house, plant breeding and trialing division of Bailey Nurseries Inc. *Hydrangea macrophylla*, big leaf hydrangea as it's commonly known, is one of the most important species currently under development in our program. As more *H. macrophylla* cultivars enter the market every year, the need for not just remontant

but strong reblooming selections has become an important target for the hydrangea breeding program.

Remontancy, often used synonymously with rebloom, is considered by many to be the ability to produce flowers on not just the previous season's growth (old wood) but on newly emerged, vegetative growth (new wood) as well (**Fig. 1**).



A.

B.

Figure 1. The difference between (A.) non-remontant, *H. macrophylla* varieties that only produce blooms on old wood and (B.) remontant *H. macrophylla* varieties that bloom on both old and new wood. Credit Bailey Nurseries Inc. 2015.

This phenomenon can lead to continuous flowering throughout the growing season (Adkins and Dirr, 2003) which is a highly desirable trait for a crop like *H. macrophylla*, whose main appeal lies in colorful, floral displays. Remontancy is widely believed to be a qualitative trait, controlled by a single or at least a small number of genetic loci (Wu and Alexander, 2020). Observations made over the last seven years of breeding efforts at Bailey Innovations, support this belief. In our hydrangea program, we treat remontancy as a trait controlled by a single, recessive gene and we have had some success in breeding reblooming hydrangea while operating under this assumption.

In *H. macrophylla*, remontancy is a highly desirable trait that allows certain varieties to continue flowering, or rebloom, well past the point when older, non-remontant, varieties would have finished flowering. The extension of a hydrangea's normal flowering period creates added value for consumers who desire season-long, floral displays. Remontant cultivars also provide more reliable blooming characteristics for homeowners in more northerly or frost-prone regions (Wu and Alexander, 2020). Remontancy is such a valuable trait that nearly all new *H. macrophylla* cultivars claim to have the ability to rebloom. However, our observations indicate that remontant cultivars can fall into a spectrum of potency when it comes to their ability to rebloom (**Fig. 2**), with some varieties performing better than others. We have observed purportedly remontant cultivars rarely produce flowers after their initial, Spring flush, while other cultivars can be aggressive to rebloom, even after a harsh cutback. From a breeding perspective, remontancy is a relatively easy trait to incorporate into *H. macrophylla* lines but determining which lines possess the strongest rebloom can be more challenging.

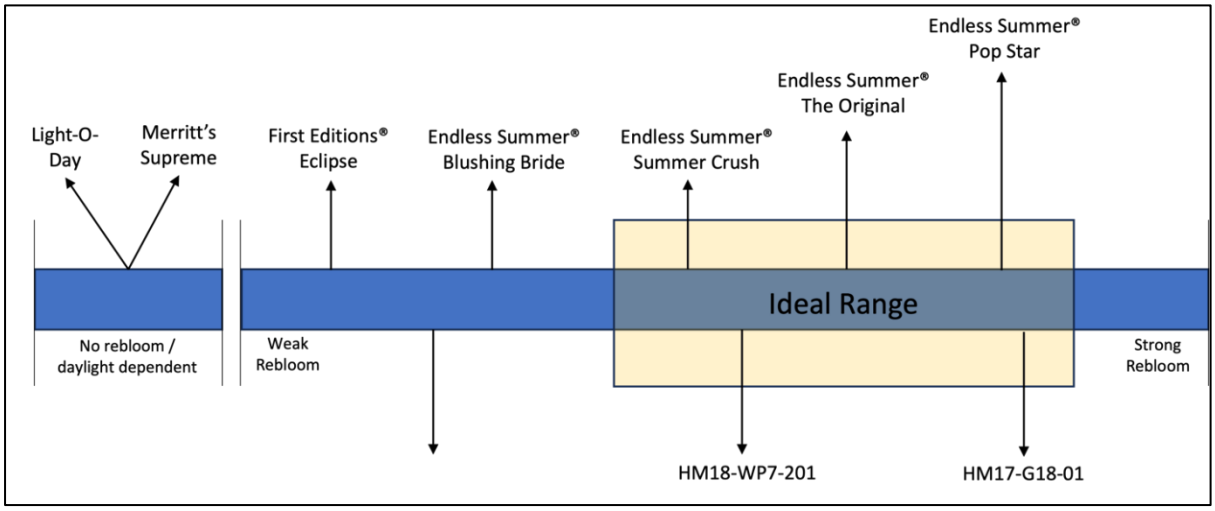


Figure 2. Theoretical scale of rebloom potency, based on 5 years of observations. Credit Justin Schulze, Bailey Innovations, 2020.

Great strides have been made in identifying the genetics mechanisms responsible for rebloom in *H. macrophylla.* Molecular testing may be able to positively identify hydrangea with remontancy but that does not guarantee a selection will rebloom to the breeder's expectation or level of standards. While remontancy appears to be a qualitative trait, the potential for strong rebloom may be more quantitative in nature, with many developmental factors contributing to whether a hydrangea will rebloom aggressively or weakly. The plant breeding team at Bailey Innovations believe the best way to accurately and confidently evaluate a hydrangea's reblooming potential, is through several years of trialing.

Evaluating for Strong Rebloom in *Hydrangea macrophylla*

First-Year Seedling Evaluations

Bailey Innovations™ typically grow between 10,000 - 15,000 *H. macrophylla* seedlings each year. Seed is germinated in late December and grown in a greenhouse until early to mid-March. Around mid-March, seedlings are transplanted into 3-gallon containers where they are fertilized with three tablespoons of Florikan 18-6-8, 270-day, control release fertilizer (CRF) and allowed to grow for several months while being observed for floral development. By June / July, seedling populations are approximately 6-7 months old and do not possess any growth from the previous season (old wood) for the plants to produce flowers on. The only growth these seedlings have is from the current season's, vegetative growth (new wood). According to the definition of remontancy, any seedling that is capable of flowering after only a few months of vegetative growth could be considered remontant. The hydrangea seedling populations at Bailey Innovations™ are frequently derived from parents which possess some degree of remontancy, so we often see very large sectors of seedling populations flower within a few months of germination. Since it is not realistic to keep every seedling that flowers in its first year, initial selections are based on unique aesthetics, quickness to flower, bloom load and overall biomass accumulation. These advanced selections are then moved to a holding area

where they are observed for 2-3 years to gauge their rebloom potential. These selections are not pruned in their first year of observation, this allows the plants to build a strong body in year one, accommodating future propagation trials and allowing for seasonal cutback evaluations to occur the following year.

Seasonal Cutback Evaluations

The first step in quantifying strong-rebloom potential for advanced selections is a seasonal cutback evaluation that occurs twice, every year. In Winterville, GA, peak bloom for *H. macrophylla* typically occurs in early to mid-June. We allow our advanced selections to reach peak bloom before we perform an early-season cutback, usually around June 15th. A hydrangea in its first year of seasonal cutback evaluation will be pruned to about 3 - 4" above the rim of the container. With older selections, the cutback is less severe but still aims to eliminate at least half of the accumulated biomass. This practice is meant to eliminate preformed flower buds that may still be present on the previous season's growth. The pruned selections will re-flush vegetative growth from the areas that were cut back and we consider any flower buds that develop from this new growth to be rebloom. The strongest rebloomers are flagged for future propagation and production trials that will occur the following year.

The final aspect of the seasonal cutback evaluation comes in late-Fall, when all hydrangea selections are again, cut back to eliminate about half of the biomass which accumulated since the early-season cutback occurred.

A common frustration for some homeowners comes in not knowing when to properly prune their hydrangea in the landscape. Older varieties of *H. macrophylla* should not be pruned in the Fall as doing so could eliminate the next season's flower buds that have already developed on old wood. The late-season cutback evaluation is meant to address this concern, if an advanced selections does not flower in the Spring that follows a Fall cutback, it is eliminated from our program.

Rebloom Trials:

Once an advanced selection has made a positive impression through the seasonal cutback evaluations, it is flagged for our production and rebloom trials. The flagged hydrangea are propagated with a goal of having a minimum of 10 clones to trial for each selection. Two-node propagules are collected around mid-June, treated with 1,000 ppm K-IBA and stuck into 32 cell trays filled with Sunshine® Mix #4 Professional Growing Mix. Approximately two weeks after the cuttings are stuck, they are top dressed with a half teaspoon of Osmocote 15-9-12, 90 day CRF. The hydrangea cuttings are typically pruned or "tipped back" once or twice before they are upshifted into a different house. Approximately two months after the initial stick date, the hydrangea cuttings are upshifted into 3-gallon containers where they are topdressed with 2 tablespoons of Osmocote 15-9-12, 90 day CRF. The cloned hydrangea selections are left to grow until Fall / Winter when they are consolidated so they can be protected from unseasonable weather. In the Spring of the following year, the hydrangea selections are distributed to a production area where the rebloom trials occur. Once buds begin to swell, the plants are lightly pruned for shape and to remove

any stems that were damaged over the course of the winter.

The rebloom trial is divided into a year-one study and a year-two study. Selections in both studies are evaluated in replicates of 10 and grown in identical conditions. From April to mid-June, we collect initial bloom data on the same day of each week. The average number of blooms for each selection is determined by adding together the total number of floral buds counted in each clonal block and dividing by the number of clones. For our trial, we count any floral bud that is dime-sized or larger and once a bloom begins to decompose, it is no longer counted. Once we begin collecting data, we quantify how long it takes a selection to flower, the time to reach peak bloom, bloom quantity and bloom duration. As with the seasonal cutback evaluations, we allow the *H. macrophylla* selections in the rebloom trial to reach peak bloom (**Fig. 3A**) before they are pruned, which usually occurs around mid-June. All selections in the year-one rebloom trial are pruned to 3 - 4" above the rim of the container (**Fig. 3B**).

Figure 3. *H. macrophylla* selections in year-one rebloom trial. (A) pre-cutback in early June and (B) post cutback in mid-June. Winterville, GA. 2022.

Plants in the year-two rebloom trial receive a less severe cutback but we still aim to eliminate at least half of the accumulated biomass. Cutting the *H. macrophylla* selections back this harshly, in early Summer, results in a relatively quick flush of new, vegetative growth. When we observe floral buds developing from newly emerged, vegetative growth, we consider a selection to be reblooming. Once a single selection begins to rebloom, we resume collecting data for the entire trial. We make note of how long it takes a selection to rebloom, the time to reach peak rebloom, rebloom quantity and rebloom duration. On average, most known varieties take between 6-8 weeks to initiate floral buds after a hard pruning but we have observed internal selections that produce floral buds in as few as 3 weeks after the initial cutback (Fig. 3). The best performers in the year-one rebloom trial are saved for the next season's, year-two rebloom trials and are re-propagated so we can have the same selection represented in year-one and year-two rebloom trials at the same time. Any selections that do not perform to our expectations are eliminated from trial.

Selections are considered top performers if they rebloom quickly after a cutback and produce a relatively high number of floral buds throughout the post-cutback evaluation. Overall bloom load and density are valuable metrics but we also look at weekly bloom averages and seasonal averages (**Fig. 4**) to determine which selections are the most aggressive rebloomers. We have recorded instances of selections that produce so many blooms they fail to accumulate enough biomass to fill a pot by the end of the growing season. We believe this is due to the amount of energy invested in floral vs. vegetative development. Unfortunately, these selections do not offer production values high enough to warrant introduction.

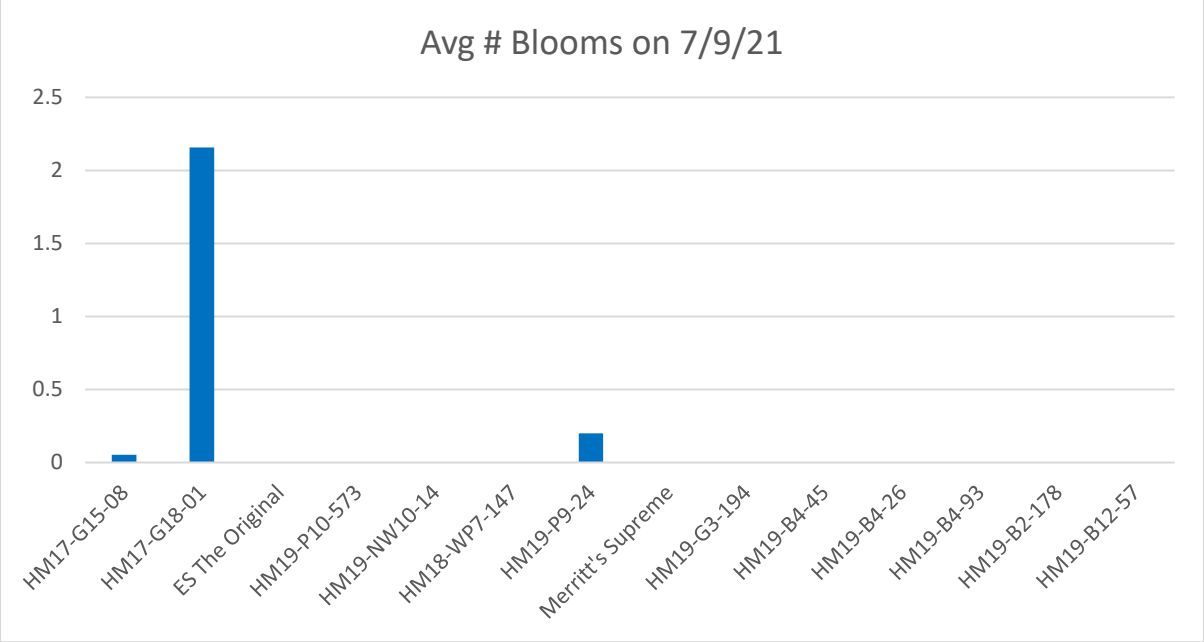


Figure 4. Average number of blooms recorded the week of July 9th, 2021, 24 days after cutback.

After two years of positive results from the rebloom trials, our top selections are flagged for additional trialing and distributed to various locations. Selections are entered into container trials at Bailey facilities located in GA, MN, IL and OR to gauge their production values and all selections planted in-ground, at Bailey facilities located in MN and IL to gauge cold tolerance. We often see a correlation between aggressive rebloomers and strong flowering performance in regions where Winter temperatures drop below a certain threshold. In Minnesota, where temperatures can often drop below - 20°F, all stems on *H. macrophylla* are killed back entirely, leaving only the crown and roots of a plant alive. Our strongest reblooming *H. macrophylla* selections will regrow from the crown and eventually flower from the newly emerged, vegetative growth. The higher a plant's rating in regard to rebloom strength, the stronger its flowering performance will often be in colder, Northern regions. Any non-remontant, *Hydrangea macrophylla* that experience total stem dieback will fail to flower the following Spring, further reflecting the limitations of varieties that are incapable of reblooming.

LITERATURE CITED

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