Evaluation of *Hydrangea macrophylla* cultivars for remontant flowering.

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Studies to quantify differences in flowering characteristics and cold hardiness among *Hydrangea macrophylla* cultivars were conducted at the Center for Applied Nursery Research (CANR) and The University of Georgia. *Hydrangea macrophylla* forms flower buds in the fall in response to decreasing photoperiods and cooler temperatures. Typically, these are the only flower buds formed for the following season. Therefore, if buds are damaged or killed by low winter temperatures or late spring frosts, flowering would be theoretically lost for the entire season. However, this is not always the case since variation in flowering potential has been reported. For instance, flowering has been observed on numerous cultivars originating from the current season's growth.

H. macrophylla 'Endless Summer' was observed flowering 11 September 1998 in the Bailey Nurseries trial plots in St. Paul, Minnesota. Based on observations, *H. macrophylla* 'Endless Summer' provides many more flowers beyond those initiated during the previous year. The benefit is that even if cold damage occurs flowering will still occur. Greenhouse studies have shown that either short photoperiods (8-hour days) at approximately 75 ºF or low temperature around 18 ºF are optimal for floral induction in several *H. macrophylla* cultivars. This mimics fall conditions when floral induction typically occurs in *H. macrophylla*. Under various non-inductive conditions, little floral induction was observed. This supports the common assumption that all *H. macrophylla* taxa flower primarily on old growth. However, various reports have asserted that the remontant flowering, or reblooming, types have been observed. This is further supported by our observations of *H. macrophylla* 'David Ramsey', 'Decatur Blue', 'Endless Summer', 'Oak Hill' and 'Penny Mac' at The University of Georgia, Athens.

In a greenhouse study, we tested 10 *H. macrophylla* taxa for remontant flowering potential. Plants were placed in either inductive or non-inductive conditions and evaluated for floral induction and development over a nine-week period. Although inductive conditions hastened floral induction, several taxa showed significant floral bud development after nine weeks of non-inductive conditions. The implication is that flowering could occur regardless the presence preformed flower buds. Cultivars showing the most significant remontant flowering potential were *H. macrophylla* 'Endless Summer', 'Lilacina', 'Mme. Emile Mouillére' and 'Penny Mac'. To further test the flowering potential of various *H. macrophylla*, ten cultivars were subjected to various pruning treatments in late winter and flowering potential was evaluated the following season.

Materials and Methods:

In April 2000, liners of ten *H. macrophylla* cultivars ('All Summer Beauty', 'Dooley', 'Endless Summer', 'Forever Pink', 'Générale Vicomtesse de Vibraye', 'Goliath, 'Mme. Emile Mouillère', 'Nikko

Blue', 'Penny Mac' and 'Veitchii') were transplanted into #3 nursery containers at The Center for Applied Nursery Research. Plants were grown under shade and maintained using standard nursery practices until treatments began on 27 Feb. 2001. Treatments included 1) removal of all preformed flower buds 2) pruning back ½ , 3) pruning back ¾. A control with no pruning was included. Treatments were completely randomize with five replicates per treatment per cultivar. Total inflorescences at anthesis were recorded monthly for each plant and averaged.

Resutlt and Discussion:

Results from the 29 May and 22 June evaluations correlate well with prior reports of peak flowering periods of late May through June for *H. macrophylla* in the southeastern U.S. (Table 1 and 2). Almost no flowering occurred on pruned and disbudded plants by 29 May (Table 1). On 22 June, average flowers per plant declined in controls of 'Endless Summer', 'Nikko Blue', 'Penny Mac', and 'Veitchii' compared with 29 May observations (Table 2). Average flowers per plant increased for cultivars and treatments on 22 June except 'Veitchii' pruned ½. The most dramatic increases on this date were for 'All Summer Beauty', 'Mme. Emile Mouillère', and 'Nikko Blue' (Table 1).

Flowering in controls continued to declined from 25 July and 28 Aug (Table 3 and 4). Average flowers per plant of 'Endless Summer', 'Goliath', and 'Penny Mac' on 25 July was considerably greater than other cultivars over all treatments (Table 3). On 28 Aug., only 'Endless Summer' and 'Penny Mac' flowered over all treatments (Table 4). For 'Endless Summer' flowering was greatest on debudded plants while 'Penny Mac' plants pruned ½ flowered best on 28 Aug. (Table 4).

Considering the data available to date, flowering from current season's growth following slight (debud) to moderate (Prune ½) shoot reduction appears to be most likely in 'Endless Summer' and 'Penny Mac'. This observation correlates well with empirical and observational data of 'Endless Summer' and 'Penny Mac' flowering behavior. Number of lateral flower buds remaining on plants following treatments was not controlled in this experiment. Therefore definitive conclusions regarding remontant flowering are not possible based on this study alone. However, flowers developing from lateral buds are potentially as effective as newly formed flowers and provide a viable method for reliable flowering in hydrangeas.

The popularity of hydrangeas for the landscape and pot-plant trade has increased in recent years as gardeners rediscover its aesthetic attributes. However, few new introductions and improvement have been made. In fact, many popular extant cultivars have been cultivated for over 100 years. Based on our observations and the observations of gardeners, nursery personal and scientists around the world, enough variation exists within the species to develop new garden types with superior aesthetic qualities and flowering characteristics. Integrating these characteristics into reliable flowering cultivars would provide novel cultivars for the nursery and landscape industry.

Table 1. Number of fully developed inflorescences per plant on 29 May. Averages are based on five repetitions per treatment.

	Treatments			
	Control	Debud	Prune ½	Prune ¾
'All Summer Beauty'	15	0	0	0
'Endless Summer'	9	1	0	0
'Forever Pink'	1	0	0	0
'Goliath'	8	0	0	0
'Mme. Emile Mouillère'	12	0	0	0
'Nikko Blue'	20	0	1	0
'Penny Mac'	10	0	0	0
'Veitchii'	21	1	0	0

Table 2. Number of fully developed inflorescences per plant on 22 June. Averages are based on five repetitions per treatment.

	Treatments			
	Control	Debud	Prune ½	Prune ¾
'All Summer Beauty'	15	6	4	5
'Endless Summer'	4	2	1	2
'Forever Pink'	9	3	3	1
'Goliath'	17	3	3	1
'Mme. Emile Mouillère'	12	6	9	7
'Nikko Blue'	11	6	5	4
'Penny Mac'	4	2	1	2
'Veitchii'	7	3	1	0

Table 3. Number of fully developed inflorescences per plant on 25 July. Averages are based on five repetitions per treatment.

	Treatments			
	Control	Debud	Prune ½	Prune ¾
'All Summer Beauty'	1	2	1	2
'Endless Summer'	3	7	5	2
'Forever Pink'	1	4	3	1
'Goliath'	3	7	3	3
'Mme. Emile Mouillère'	2	4	1	1
'Nikko Blue'	1	3	3	2
'Penny Mac'	0	11	10	6
'Veitchii'	1	2	1	0

Table 4. Number of fully developed inflorescences per plant on 28 Aug. Averages are based on five repetitions per treatment.

	Treatments			
	Control	Debud	Prune ½	Prune ¾
'All Summer Beauty'	0	1	2	0
'Endless Summer'	2	6	3	2
'Forever Pink'	0	0	0	0
'Goliath'	0	0	0	0
'Mme. Emile Mouillère'	0	0	0	0
'Nikko Blue'	0	0	0	0
'Penny Mac'	1	2	8	3
'Veitchii'	1	0	0	0