Frost proof magnolias: How to develop them

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This article deals entirely with magnolias of the Yulania Subgenus.

It is a most painful experience for dedicated plantsmen to see a large tree magnolia destroyed by an overnight frost. One day the tree is covered with indescribably beautiful flowers, the next day nothing is left but a tree full of ugly, brown dead flowers. Yet such is the experience that comes far too frequently.

Some nurserymen, perplexed by these all-too-frequent occurrences, have either discontinued sales of these magnolias entirely, or else have curtailed them. The destruction of magnolia flowers in many years by frosts prevents magnolias from becoming popular with most homeowners. In my opinion it is the single most limiting factor to their wider acceptance.

Frost damage to magnolia flowers occurs in almost all parts of the world where these plants are grown. Homeowners are discouraged when they cannot grow a plant with a better-than-average certainty that they can flower it in a majority of seasons. Yet with present day cultivars successful flowering occurs all too infrequently. With little effort late flowering, frost-proof cultivars can be readily developed by any hybridizer. Breeding materials are widely available, and the methods are very simple. Why then do we not have frost-proof cultivars?

With one possible exception both past and present day magnolia hybridizers, to my knowledge, have failed to consider late-flowering as a major objective of their programs. All too often the parental material used has been too early season in its flowering because it comes from an area of the world where damage from frosts is not a common problem. Little effort has been made to develop clones that will flower ten days to two weeks later in the spring than most existing cultivars. It is the purpose of this discussion to suggest parental material and breeding methods to develop frost-proof magnolias.

The beginnings of frost-free magnolias—

If I were to cite the major mileposts of magnolia improvement, I would cite only two, the development of the Soulangiana hybrids in France in the 1820s and the recent development of hybrids of *M. acuminata* a century and a half later at the Brooklyn Botanic Garden. The first opened the eyes of the plant world to the potentials of magnificent magnolia hybrids, while the second opened the way to the fruition of those potentials. The Soulangiana hybrids created the appetite for beautiful flowers while the Brooklyn program provided the basis for satisfying that appetite by

charting the pathway to late flowering germplasm needed to develop frost-proof hybrids. Many breeding programs such as that of Todd Gresham have used the germplasm of E. Soulange-Bodin and have produced secondary improvements, but the Brooklyn program in its use of *M. acuminata* pioneered an entirely new breakthrough by providing germplasm that is late flowering and hence can escape frost damage. *Magnolia acuminata* is the cornerstone to frost proof magnolias.

Magnolia acuminata and its attributes—

Magnolia acuminata is the only member of the Yulania Subgenus that is a native of the New World. All other members come from Asia. It was first described by M. Catesby in *Flora Caroliniana* in 1741, having first been introduced into cultivation about five years earlier in 1736.

It ranges generally from the northern shores of Lake Erie and Lake Ontario in Canada southward along the Appalachian Mountains to the West Feliciana Parish hills of east central Louisiana, where relict populations of many northern plants forced there by the ice sheets survive side by side with strictly southern flora. It is hardy to about -30°F (-34.7°C) and perhaps even lower.

In the mountains of western North Carolina it typically flowers in late May to early June, well after the danger of frost. Of great importance, this species imparts its late flowering characteristic to its offspring. For example I have a hybrid of Brooklynensis x Brooklynensis that flowers into July. Unfortunately this hybrid sets no seed, but will function as a pollen parent.

The flowers of *M. acuminata* are usually a greenish yellow and relatively small in size. However, some selections such as the one discovered by Frank Galyon and named 'Golden Glow' have good yellow flowers and have great horticultural value in their own right. Hybrids of *M. acuminata* and its close relative *M. cordata* are intensely yellow in color. A selected hybrid of *M. cordata* 'Miss Honeybee' and *M. acuminata* 'Golden Glow' in my garden has intensely yellow colored flowers of fair size produced in abundance. Despite these many attributes of *M. acuminata*, the genetic character of greatest potential for magnolia improvement is the lateness of flowering. It is this attribute which needs to be incorporated into the Soulangiana group to develop the new race of frost proof magnolias.

The attributes of the Soulangiana hybrids—

For over 150 years the Soulangiana hybrids have been the most popular of all the magnolias. They are unrivaled in their beauty, hardiness, ease of propagation, and adaptability to many growing conditions. They are near perfection in save one respect: they flower too early for the most part and hence are subject to having their flowers destroyed by freezing. They are not frost proof.

The Soulangianas have been the parents of many secondary breeding programs. Unfortunately, for the most part, they have passed their early flowering tendency to such

offspring to the detriment of these offspring.

I propose that the Soulangiana hybrids be repeated after all these years, using the original parents that have been altered only by incorporating the late flowering genes of *M. acuminata* into their inheritance. It is an ambitious program but one that can be accomplished quite easily despite its overlarge aspirations. We have at hand both the raw materials and the methods of accomplishment.

Breeding methods for developing late flowering cultivars—

There are two basic methods by which late flowering, frost proof clones can be developed: (1) the time tested backcross method and (2) intercrossing of existing late flowering cultivars. I will discuss each method and the parental material to be used in each method. I strongly favor the backcross method because it permits the restructuring of the Soulangiana hybrids mentioned above.

Backcrossing: By backcrossing one concentrates on a single genetic characteristic which one wishes to transfer from one species to another species. It is the method used to improve a given species unchanged except for the incorporation of a single factor from another species.

Thus with magnolia species inherent in this discussion the materials at hand are (a) *M. acuminata*, which has the desired late flowering characteristic; (b) the species *M. liliiflora* and *M. denudata*, which are proven parents of a superb race of magnolias but which lack late flowering.

The objective of combining the desirable germplasm of (a) and (b) is readily accomplished by the backcross method.

Step I is to make the initial crosses between *M. liliiflora* and *M. acuminata* and between *M. denudata* and *M. acuminata*. However, this step has already been done by the Brooklyn Botanic Garden and others. It is only a matter of choosing one of the respective hybrids already available to everyone to accomplish this initial step. For example, hybrids between *M. acuminata* and *M. liliiflora* are x 'Woodsman,' x 'Evamaria,' x 'Golden Girl,' x 'KO1,' or x 'KO2.' All of these mentioned are fertile both as seed parents or as pollen parents.

Likewise there already exist hybrids between *M. acuminata* and *M. denudata*, including x 'Elizabeth,' x 'Sundance,' and x 'Butterflies.' However, all these hybrids function best as pollen parents. It is almost impossible to use them as seed parents. As a result, please note that I have diagrammed the cross as it must be made in the denudata line. (Table A)

Thus in the completion of Step IV one would have plants of both parental lines (*i.e. M. liliiflora* and *M. denudata*) that carry 87.5% of the genes of their respective parents in addition to the later flowering characteristic which came in earlier generations from *M. acuminata*. In reality these plants will closely resemble *M. liliiflora* and *M. denudata* in all respects except they will flower 10 days to 2 weeks later - and more likely more than 2 weeks later. By crossing the products of Step IV one obtains clones of

TABLE A

Seed parent noted '+' and pollen parent noted '^'

Liliiflora Line	Denudata Line
Step I Select one of the above 5 hybrids. (I will select Woodsman for example)	Step I Select one of the above 3 hybrids. (I will select Sundance for example)
Step II Hybridize Woodsman+ x *M. liliiflora*^ Select latest flowering clone in the progeny.	Step II Hybridize *M. denudata*+ x Sundance^ Select latest flowering clone in the progeny.
Step III Above latest flowering clone is crossed again with *M. liliiflora*. Select latest flowering clone in the progeny as well as the one which is most like *M. liliiflora*.	Step III Above latest flowering clone is crossed again with *M. denudata*. Select latest flowering clone in this progeny as well as the one which is most like *M. denudata*.
Step IV Best liliiflora-like late flowering clone from Step III (which now has 87.5% of liliiflora genes)	Step IV Best denudata-like late flowering clone from Step III (which now has 87.5% of denudata genes)

Hybridize

Step V
Late soulangiana types with only 12% of acuminata genes.

Soulangiana types which likewise will have a majority of the progeny flowering much later than the traditional Soulangiana hybrids. Although they still carry a small number of *M. acuminata* genes, they would resemble the traditional Soulangiana hybrids.

In my own hybridization program I am in Step II for *M. liliiflora*. Because *M. denudata* is so highly susceptible to frost damage, I am not so far along on this side of the backcrossing program.

It should be pointed out that among the plants developed in Steps II to IV will be many candidates for cultivars suitable and worthy of naming and registration. One can never predict what will arise from the reassortment and recombination of genes of one species with another

species. For examples of such reassortment and recombination in past experience, one needs only to look at the huge number of cultivars that have arisen from the initial cross of the species *M. liliiflora* and *M. denudata*. Consequently it is too early to assess the potentials of reassortment and recombination of *M. acuminata* genes with other species. We have not yet had sufficient time to evaluate them in parental germplasm.

Likewise the genes for yellow color of *M. acuminata* for flower color could interact in giving pastels not known today. I have recently obtained a very fragrant pure pink that is light Neyron Rose on the color scale from a cross of *M.* x 'Woodsman' and a white Gresham. This color and the fragrance would not be expected to arise from that cross, but it illustrates the possibilities of *M. acuminata* as a parent.

Intercrossing late flowering types—

It has been difficult to identify among the present day hybrids in the Yulania subgenus those that are late flowering. Such information is difficult to find. Descriptions of magnolias do not adequately pinpoint this information to identify those which flower late enough to escape frost damage. Table B below represents my best efforts to identify late flowering clones. Undoubtedly it is far from complete.

TABLE B

Name of species or hybrid	Recommended by
Brozzonii	Unknown
Lombardy Rose	Carl R. Amason
Grace McDade	Unknown
Purpliana	Unknown
Jon Jon	John Allen Smith
Moonlight(Gresham)	Frank Galyon
Verbanica	Karl Flinck
Speciosa	Karl Flinck
M. liliiflora 'Osaka'	Louisiana Nursery
M. liliiflora 'Holland Red'	Joe Hickman

By intercrossing the above clones one can select a wide range of late flowering offspring. This method has the advantage of accomplishing results at an earlier date than the more time consuming backcross method. However, in my judgment, the latter method in the long run will result in much later flowering cultivars as the result of the infusion of *M. acuminata* genes.

Frost proof magnolias can be developed. Let us do it. ❧