

Fixing *Invasive* Nursery Crops

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Human beings have been cultivating, trading, breeding and distributing plants since the dawn of civilization. Plants are part of our culture, spanning generations and geopolitical boundaries. This ongoing domestication of plants has transformed our crops, gardens, food supply and landscapes, enhancing our quality of life in many positive and profound ways.

Most introduced plants have not been problematic. Globally, only about 4% of non-native species have naturalized. Of course, the presence and naturalization of a non-native species is not necessarily a problem — many introduced plants provide positive ecosystem services such as erosion control, reduced stormwater runoff, pollinator services, wildlife food and habitat, and enhanced biodiversity — particularly in urban and disturbed environments. However, in very limited cases, some non-native species can get out of hand and have negative impacts on ecosystem processes, native community composition and ecology. So, how can we address the few bad actors?

More careful screening to avoid the introduction of species with invasive properties is certainly important. In other cases, where valuable nursery crops are problematic and weedy, the development of low-fertility/seedless cultivars can be an ideal alternative. This problem-solving approach preserves the economic, ecological and aesthetic value of these plants, while minimizing potential negative impacts associated with unintended spread. Other benefits of reduced-fertility introductions can include enhanced flowering and re-blooming, reduced fruit litter, and reduced pollen allergens.

Despite the potential of reduced-fertility cultivars, the absence of a clear framework for their development and evaluation has hindered consistent adoption and policy alignment. Recently, Dr. Ryan Contreras and I led a national effort and working group to develop a consensus and to review approaches for developing and evaluating low-fertility landscape cultivars to minimize self-sowing and potential invasiveness (Contreras, et al., 2025). Specific recommendations and conclusions from this paper included the following:

1. Selecting and developing cultivars with reduced fertility is a viable approach for maintaining economic, environmental and aesthetic benefits of important landscape crops while minimizing potential invasiveness.
2. A 98% reduction in fertility, compared to fertile controls, is an achievable and practical criterion for accepting low-fertility cultivars as alternatives to potentially invasive, sexually reproducing plants.
3. Regulations of potentially invasive plants should include exclusions and provisions to allow for the continued production of cultivars with documented low reproductive fertility.

We hope that this paper and effort will help inform decision-makers across the country on the adoption of uniform guidelines and policies that allow for the further development and cultivation of these improved, problem-solving crops.



Figure 1. My Fair Maiden™ Maiden Grass (*Miscanthus sinensis* 'NCMS1' USPP26387P3). Photo credit: Tom Ranney.



Figure 2. High Frequency™ Maiden Grass (*Miscanthus sinensis* 'NCMS3' USPP34712P2). Photo credit: DarwinPerennials®.



Figure 3. Bandwidth™ (*Miscanthus sinensis* 'NCMS2B' USPP29460P2). Photo credit: DarwinPerennials®.

Closer to home, our team here at North Carolina State University's Mountain Crop Improvement Lab has been working for decades on developing seedless forms of important, although sometimes weedy, nursery crops. These seedless selections have been developed specifically for low reproductive fertility to minimize self-sowing and potential invasiveness. These plants may be triploid or have other mechanisms whereby seed production is greatly reduced or rare, but not necessarily zero. A few of these cultivars are described below.

Maiden Grass (*Miscanthus sinensis*). Native to the mountains of Japan, Maiden Grass has found a good home in the mountains of Western North Carolina and other parts of the country, where it has naturalized along roadsides, old fields and disturbed sites. As a pioneer species that is relatively shade-intolerant, Maiden Grass tends to fade out with natural succession, but thrives in areas like roadsides where periodic mowing suppresses competition. We have developed and introduced three triploid cultivars of Maiden Grass that were bred to have low fertility and a combination of desirable ornamental features. My Fair Maiden™ Maiden Grass (*Miscanthus sinensis* 'NCMS1' USPP26387P3) is big and bold with showy flowers, reaching 7-9 feet high (Fig. 1). High Frequency™ Maiden Grass (*Miscanthus sinensis* 'NCMS3' USPP34712P2) is more compact, reaching 6-7 feet tall, with attractive horizontal banding (Fig. 2). Bandwidth™ (*Miscanthus sinensis* 'NCMS2B' USPP29460P2) is the shortest of the bunch, coming in at under 3 feet high with horizontal banding (Fig. 3).

Barberry (*Berberis* spp.). Fertile barberry have become a problem in some U.S. regions, particularly the Northeast and Midwest. Yet they are adaptable, deer-resistant plants with a range of desirable ornamental traits, including colorful foliage and unique forms. We have developed two highly infertile Barberry cultivars. Sunjoy Mini Maroon® (*Berberis thunbergii* 'NCBT1' USPP30330P3) has deep red/maroon foliage with a compact habit, similar to 'Concord', ultimately reaching 2-3 feet in height (Fig. 4). Sunjoy Todo® (*Berberis* 'NCBX1' USPP29504P3) also has great purple foliage color but is even smaller than Mini Maroon®, maturing at 1.5-2 feet tall (Fig. 5).

Scented Silverleaf (*Elaeagnus ×ebbingei* 'NCEX1' Mr. Smooth™ PPAF). Imagine a refined plant sporting shimmering evergreen foliage and subtle flowers with a pungent, enchanting fragrance. Oh, and one that is tough,



Figure 4. Sunjoy Mini Maroon® (*Berberis thunbergii* 'NCBT1' USPP30330P3). Photo credit: Spring Meadow Nursery.



Figure 5. Sunjoy Todo® (*Berberis* 'NCBX1' USPP29504P3).
Photo credit: Spring Meadow Nursery.

adaptable, salt-tolerant and deer-resistant; roots from cuttings; and fixes its own nitrogen! Yes, it's an *Elaeagnus*, but unlike other *Elaeagnus* you may know, we made some improvements to this one. Mr. Smooth™ is thornless and compact (it doesn't throw errant "rat tail" shoots), and is also a seedless triploid. We kept all the good stuff, fixed some of the problems, and selected the new common name of "Scented Silverleaf" to better reflect its desirable traits (Fig. 6).

Flowering Pears (*Pyrus* spp.). Callery pears (*P. calleryana*) became popular for a reason. In 1964, *The New York Times* published an article stating that "Few trees possess every desired



Figure 6. Fragrant Silverleaf (*Elaeagnus* x*ebbingei* 'NCEX1' Mr. Smooth™ PPAF).
Photo credit: Spring Meadow Nursery.



Figure 7. Chastity™ Flowering Pear (*Pyrus* x*triploida* 'NCPX2' USPP30788P2).
Photo credit: Tom Ranney.

attribute, but the Bradford ornamental pear comes unusually close to the ideal" (Dengler). True, it's tough and adaptable, is particularly pest-resistant, and has showy flowers and spectacular fall color. Unfortunately, Callery pears have become infamously weedy. In response, we set out to develop an improved noninvasive pear hybrid. Chastity™ Flowering Pear (*Pyrus* x*triploida* 'NCPX2' USPP30788P2) is a complex triploid hybrid involving *P. calleryana*, *P. betulaeifolia*, and *P. fauriei*. It is highly resistant to fire blight, highly infertile, with showy flowers and fall color, has good branch structure and an upright, pyramidal form — so it features lots of improvements, in addition to low fertility (Fig. 7). We gave it the new hybrid name of *Pyrus* x*triploida* to differentiate it from fertile types of Callery pear. Although Chastity™ is a great plant, we may have gotten to the game too late, as ornamental pears in general are now being broadly villainized, and the general public may not recognize the difference between the good and the bad.

Japanese Spiraea (*Spiraea japonica*). Spiraea are extremely popular landscape plants valued for their broad adaptability and bright flowers and foliage. Here in Western North Carolina, I occasionally see *Spiraea* naturalized along roadsides and under power lines, but rarely in the woods. In some locations, particularly in the Northeastern U.S., Japanese Spiraea has been flagged by some as an emerging invasive species. To mitigate this risk and gain some of the valuable ornamental characteristics connected to reduced fertility, our program focused on developing improved seedless triploid forms of Spiraea. Thus far, we have developed and introduced two selections. Doubleplay® Candy Corn® Japanese Spiraea (*Spiraea japonica* 'NCSX1' USPP28313P2) is very compact (1.5-2.5 feet high and wide) and crazy colorful (Fig. 8). In the spring, the new foliage emerges a candy apple red and transitions to a pineapple yellow, topped off with dark purple flowers. If you're looking for eye-popping color, look no further! Doubleplay® Doozie® Japanese Spiraea



Figure 8. Doubleplay® Candy Corn® Japanese Spiraea (*Spiraea japonica* 'NCSX1' USPP28313P2). Photo credit: Spring Meadow Nursery.

(*Spiraea japonica* 'NCSX2' US20190281743P1) is a completely different animal. Doozie® is a medium-sized shrub (2-3 feet high and wide). New foliage emerges purplish red and matures to dark green, accompanied by saturated red flowers (Fig. 9). What came as a surprise is that the lack of seed production appears to make Doozie® a continuous bloomer. As long as it's growing, it's flowering — no deadheading or pruning required.

The list goes on. Other seedless introductions from our lab include: 'Chastity' Trumpet Vine (*Campsis ×tagliabuana*), the Double Take® Flowering Quince (*Chaenoemeles speciosa* 'Scarlet Storm' USPP20951P2; 'Orange Storm' USPP20950P2; and Peach 'NCCS4' USPP30231P3), Kindly® Japanese Privet (*Ligustrum japonicum* 'NCLJ1' USPP35881P2), Golden Ticket® Privet (*Ligustrum* 'NCLX1' US20160029531P1), and Fire Ball Seedless® Burning Bush (*Euonymus alatus* 'NCEA1' PPAF). For more information on these plants, check out <https://mcilab.cals.ncsu.edu/plant-introductions/>.

Developing seedless plants is not particularly easy or fast — many of these projects have taken decades to complete. However, as an industry, we recognize the importance of addressing this issue. At NC State, while we continue to utilize traditional breeding techniques to develop noninvasive varieties, we are also



Figure 9. Doubleplay® Doozie® Japanese Spiraea (*Spiraea japonica* 'NCSX2' US20190281743P1). Photo credit: Spring Meadow Nursery.

exploring new biotechnologies to expedite the process. Gene-editing approaches, such as CRISPR-Cas9, have the potential to precisely suppress key genes essential for plant reproduction, rendering plants seedless. This approach would enable us to take existing, elite cultivars and simply turn off reproduction without making any other changes. Initially, we are testing this approach on different grasses. If this works, it will be game-changing!

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Citations:

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