

Breeding Non-Invasive Nursery Crops®

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BACKGROUND

Concern and awareness over invasive plants continues to grow. Most states have formed exotic plant pest councils (<http://www.invasivespecies.gov/other/orgcouncil.shtml>) and many agencies, organizations, and individuals have developed and distributed “black lists” of plants that they feel should not be grown. Many of these lists include plants that are currently being produced by the nursery industry. The Connecticut legislature passed Public Act 04-203 in 2004 prohibiting the importing, moving, selling, purchasing, transplanting, cultivating or distributing of 81 different plants with penalties of up to \$100 per individual plant. In 2005, the Commissioner of Agriculture in New Hampshire adopted an Invasive Species Rule (3800) prohibiting the collection, transportation, selling, distribution, propagation, and transplanting of 21 plants with a number of economically important nursery crops (e.g., *Acer platanoides* (Norway maple), *Berberis thunbergii* (Japanese barberry), and *Euonymus alatus* (winged euonymus) included. More recently, in 2007, the Suffolk County legislature, Long Island, passed an invasive plant law that forbids the sale, propagation and introduction of plants on a “Do Not Sell” list: (<http://www.co.suffolk.ny.us/legis/resos2007/i1144-07.htm>). Most likely, other states and counties will follow suit.

A considerable challenge in developing lists and legislation to discourage or ban the growing of problem plants, is to first objectively evaluate the harm or potential harm various plants may cause. Having clear definitions of relevant terms is an essential starting point. In 2006, the Definitions Subcommittee of the Invasive Species Advisory Committee of the National Invasive Species Council published the Invasive Species Definition Clarification and Guidance White Paper (<http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf>). In 2007, the North Carolina Nursery and Landscape Association adopted the following definitions, based on this White Paper:

Non-native Species: Species found outside their natural range boundaries as a result of human activity.

Naturalized: A non-native species that establishes self-perpetuating populations.

Invasive: A non-native species whose introduction causes or is likely to cause economic or environmental harm or harm to human health that outweighs any beneficial effects.

Various states and organizations have also been working on developing and refining Weed Risk Assessment tools to more objectively determine if a non-native species “causes or is likely to cause economic or environmental harm or harm to human

health that outweighs any beneficial effects" (Fox et al., 2005; Morse et al., 2004; Schutzki et al., 2006). In cooperation with Dr. Joe Neal, Ms. Clara Englert, and the North Carolina Nursery and Landscape Association, we are working on evaluating and tailoring a Weed Risk Assessment tool for use in North Carolina.

There are few simple means to eradicate plants that have already naturalized. However, methods are available that can help to prevent their further introduction. In addition to the more careful screening and selection of plants for sale, plant breeding can be employed to develop new, non-invasive plants. One of the most effective means for developing non-invasive, seedless plants is to create triploids — plants with three sets of chromosomes. Although triploids typically grow and function normally, they have an inherent reproductive barrier in that the three sets of chromosomes cannot be divided evenly during meiosis yielding unequal segregation of the chromosomes (aneuploids) or complete meiotic failure. Triploids have been developed for many crops including seedless bananas, seedless watermelons, grapes, and althea (Egolf 1970; 1981; 1986; 1988). Natural polyploids frequently occur in nature. Triploids can also occur naturally or can be bred by hybridizing tetraploids with diploids to create seedless triploids. Triploids are not always completely seedless. However, even in the unusual case when a triploid plant can produce seeds (apples are an example), it happens infrequently, and seedlings generally have poor viability.

STATUS OF RESEARCH

Our research group is currently working on developing a broad range of non-invasive cultivars of important nursery crops with improved commercial traits. We are currently working on developing non-invasive triploids of the following: *Acer tartaricum* subsp. *ginnala* (amur maple), *Albizia julibrissin* (silk-tree or mimosa), *Berberis* sp., *Campsis* × *tagliabuana* (trumpet vine), *Cytisus scoparius* (Scotch broom), *Euonymus alatus*, *Elaeagnus* sp. (elaeanus), *Hedera helix* (English ivy), *Hypericum androsaemum* (tutsan St. Johnswort), *Koeleruteria paniculata* (panicked golden-raintree), *Ligustrum* sp. (privet), *Miscanthus sinensis* (maiden grass), *Pyrus calleryana* (callery pear), and *Ulmus parvifolia* (lacebark elm). We have identified tetraploids of all of these species and have successfully developed triploids of *Campsis*, *Elaeagnus*, *Hypericum*, *Ligustrum*, *Miscanthus*, and *Pyrus*. Fertility of new hybrids will be thoroughly tested to determine reproductive potential (Olsen, et al., 2006; Ranney et al., 2007). Because this approach involves controlled breeding, it also provides additional opportunities for plant improvement. In addition to breeding for seedlessness, we are simultaneously working on enhancing pest resistance, environmental adaptability, and further commercial potential of these crops (Touchell et al., 2007). This project will ultimately provide new environmentally friendly cultivars that will benefit the nursery industry, our environment, and consumers.

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