

# The IETIC: Five Decades of Tree Improvement

BY MARC L. RUST

**T**he Inland Empire Tree Improvement Cooperative (IETIC) was established in 1968 by a group of foresters who recognized the need for genetically improved seed sources to ensure healthy and productive forests for the future. IETIC uses classical plant breeding techniques including selection, testing, and breeding to identify superior genotypes for inclusion in production seed orchards.



Initial efforts were focused on ponderosa pine (*Pinus ponderosa* var. *ponderosa*) tree improvement and our first progeny tests were established in 1974. During that same year, members voted to expand IETIC to include additional species (western white pine, western larch, Douglas-fir, and lodgepole pine).

During the early years, members selected phenotypically superior "plus-trees," collected open pollinated seed for progeny testing, and established and measured progeny tests. Our first-generation progeny tests have provided valuable data and genetic material for establishing seed and breeding orchards.

Recent efforts have focused on providing opportunities for IETIC members to join forces to produce genetically improved seed for their reforestation programs. While a few of our members had previously established

their own seed orchards with IETIC genetic materials, many of our members have relatively small ownerships and the fixed costs associated with developing their own seed orchards were prohibitive. To remedy this, IETIC established new cost-share seed orchards that are funded by members who want to participate. Each member pays a percentage of the establishment and management costs and receives an equivalent share of the seed produced in return.

The first cost-share seed orchard established was a western larch orchard designed to produce seed suitable for eastern Washington and northern Idaho between 2,800 and 4,200 feet in elevation. This orchard was planted in 2007 and produced its first sizable seed crop in 2014. While still very young, the orchard has produced seed each year for the past three years. Trees are topped to 2.5 meters tall once they reach 4.0 meters in height. This technique promotes the development of pendent branches in larch, which tend to produce more flowers than typical lateral branches.

In addition, IETIC members have established a cost-share ponderosa pine orchard to produce seed for eastern Washington and northern Idaho from 2,400 to 3,800 feet elevation and a Douglas-fir orchard for 3,000 to 4,000 feet elevation in the same region. Efforts are underway to identify suitable sites for two more western larch cost-share orchards, one to serve higher elevations in Washington and Idaho,



PHOTO COURTESY OF MARC L. RUST, IETIC

**Western larch seed from the IETIC cost-share seed orchard shortly after germination. Germinates will be thinned to one per cell.**

and one to serve member needs in Montana.

While these orchards are new, the cost share concept isn't new to IETIC. For many years, IETIC members shared costs to manage the R.T. Bingham western white pine seed orchard located in Moscow, Idaho. This orchard, originally developed as a breeding arboretum by the US Forest Service, has produced more than 8,000 pounds of blister rust resistant western white pine seed for IETIC members since 1993. Seed from this orchard has been deployed by members in Washington, Idaho, and Montana with good success. Currently, efforts are underway to improve the blister rust resistance level of the seed from this orchard by: 1) establishing new orchard blocks using tested materials from blister rust resistance screenings conducted at the US Forest Service Coeur d'Alene Nursery; and 2) participating with the US Forest Service in second-generation breeding efforts designed to produce improved levels of blister rust resistance for the future.

With our first generation of progeny testing largely completed and the seed orchards developed from them beginning to supply genetically improved seed to our members, IETIC has begun to plan for the future. To ensure that our best genotypes from the progeny



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tests are always available, we have been grafting them onto rootstock and planting them at the Russell H. Hudson Gene Archive located on the University of Idaho Experimental Forest. Russ was instrumental in the formation of IETIC and served as IETIC chair for more than 20 years. His leadership and commitment to the program have had a lasting impression.

In addition to preserving our best genetic materials for the future, members have recently become interested in launching new advanced generation breeding programs for two of our most important species, western larch and Douglas-fir. Breeding plans and operating agreements have been drafted and are being reviewed by members. These plans, focused on a traditional approach of full-sib crossing to produce offspring for progeny testing, are being designed to take advantage of new genomic-based tools and techniques as they become available.

As a small cooperative without a dedicated research budget, IETIC has established or funded several important studies to improve seed orchard management techniques or develop new tools to help further our efforts to develop improved seed sources for the future. Some highlights include:

1. Developing flower induction techniques to promote early flowering in western larch and ponderosa pine seed orchards. These techniques are being used in the Pullman Ponderosa Pine Seed Orchard with good success.

2. Establishing trials of stem injected systemic insecticides aimed at controlling high-value seed crops in seed or breeding orchards that cannot be easily treated using broadcast insecticide sprays.

3. Developing an illustrated publication on the reproductive biology of western larch to aid foresters and seed orchard workers interested in harvesting or producing larch seed crops. This publication is available at [www.webpages.uidaho.edu/ietic/](http://www.webpages.uidaho.edu/ietic/).

4. Developing SNP (single nucleotide polymorphic) markers for western white pine in collaboration with colleagues at Oregon State University. These genetic markers represent single changes in the base sequence at a particular location on a chromosome. If SNP markers can be found that are



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**Left: The IETIC western larch cost-share seed orchard was established in 2007. Ramets are topped to promote the development of pendant branches and allow cones to be easily harvested using orchard ladders. Right: Male and female flowers on a pendant branch.**

highly correlated to the presence (or absence) of particular blister rust resistance traits, they could potentially streamline tree breeding efforts by providing early detection of genotypes with high (or low) levels of resistance.

5. Comparing growth characteristics of open pollinated clonal seed lots collected from seven western larch clones in the IETIC seed orchard. While deployment of clonal seed lots is common in some species and regions, it has not been practiced to any significant degree with native conifer species in our region. Seed was collected in 2016 and recently sown for this study. The study includes both a nursery component to examine growth differences of seedlings and a long-term field study where the clonal lots will be outplanted in blocks along with an orchard bulk lot on three sites with two levels of competition control. The results of this study will help members decide if future crops from the orchard will be collected and processed by

clone or bulked as an orchard lot.

If there is one thing that is certain about the future, it is uncertainty. Concerns about the impact of climate change on native forests and the challenges of competing in an increasingly large global marketplace will likely intensify the importance of our tree improvement efforts. A lot has changed since IETIC was founded nearly five decades ago. However, our members continue to realize the importance of improved seed sources to ensure healthy and productive forests for the future and are committed to cooperative efforts to maintain a broad genetic base and achieve genetic gains through shared responsibilities and shared costs. ♦

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