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UPDATE ON HAZELNUT DEVELOPMENT PROGRAM IN THE LAKE STATES

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ABSTRACT

Hazelnut (*Corylus* spp.) is a potential nut crop for the Lake States. In the past, researchers and hobbyists have hybridized American and European hazelnut in an effort to develop a cold hardy, disease resistant hybrid hazelnut. There are relatively few varieties available and most plantings are currently seed origin. For pure American hazelnut, there are nearly no available varieties (at this point we know of two). Our goals are to: select high productivity wild hazelnuts, successfully pilot one or more propagation protocols and field test the selected genotypes. A group representing a diversity of disciplines and Upper Midwest States has been selecting American hazelnut from wild populations in Northern Wisconsin for use as parents in controlled crosses as well as potential clonal planting stock. To date, we have screened 35 sites across 10 WI Counties and have selected more than 30 individuals that meet 1% selection criteria on kernel yield per square foot. We are currently micropropagating these individuals for evaluation in replicated germplasm trials. We have also successfully tested mound layering protocols. This is an intermediate general report and specific results will be reported as they become available.

Keywords: filbert, breeding, yield component analysis, microsatellites, SSR

INTRODUCTION

Because American hazelnut, *Corylus americana,* is a perennial plant, its cultivation would be expected to result in fewer environmental impacts than annual crops. American hazelnut has had an important cultural history of food use by North American tribes, but has not been commercialized as a domesticated crop. European hazelnut, *Corylus avellana,* by comparison, is an internationally traded commodity crop. Turkey alone exports an annual crop valued at $1.4 billion dollars (Hazelnut and Products Exporters' Association 2010). Production in North America is predominantly in the Pacific Northwest and is only a few percent of world production (USDA FAS 2004). Commercialization of European hazelnuts in the Upper Midwest is restricted by a combination of cold hardiness issues and lack of Eastern Filbert Blight (EFB) tolerance. By contrast, American hazelnut co-evolved with EFB and has higher tolerance for the disease.

Both hobbists and researchers have been interspecifically hybridizing American and European hazelnut. While the goals of these breeders have varied, the inclusion of American hazelnut genetics has been driven by its native tolerance to EFB and its cold hardiness (Weschcke, 1954; Rutter, 1991). As far as we know, only two pure American hazelnuts varieties are commercially available for cultivation. Very few other American hazelnut genotypes are represented in the interspecific hybrid varieties. While interspecific hybrid seedlings are available from several companies, clonal varieties are lacking. Selections from wild American hazelnut populations could provide additional sources of genetics to use both as varieties and as parents in crosses.

Our overall project goals at this point were to:

1. Select wild American hazelnuts
2. Develop propagation tools
3. Assess nut quality parameters (oil, size, flavor, etc.)
4. Provide outreach to growers

METHODS AND RESULTS

Because many of these projects were still on-going at the time of submission of this paper and because the individual studies will be published through peer-reviewed venues, this paper was intended to provide an overview of the project with intermediate results as of early 2013.

Meeting Goal 1: Select wild American hazelnuts

At each site, 100 plants were screened using a visual assessment tool. After collection, drying and cracking all nut clusters, the highest productivity plants were selected. To date, 35 sites were screened across 10 WI Counties and more than 30 individuals were selected that meet 1% selection criteria on kernel yield. Initial results of this project can be found at the website: http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2016_American%20hazelnut%20yields.pdf. Screening using genetics tools (microsatellites) and morphological characteristics were still in process to better target selection efforts.

Meeting Goal 2: Develop propagation tools

Micropropagation presents a potential tool to rapidly expand high-productivity genotypes. At this point, success has varied between genotype. Due to differences in ease of propagation between genotypes, ability to propagate was added as a selection criterion. Additionally, early tests of mound layering has been successful (described at http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2015_stool%20bed%20layering%20American%20hazelnut.pdf); however, new efforts were focused on preparing stock plants for a pilot scale test where the plants would resemble commercially managed beds.

Meeting Goal 3: Assess nut quality parameters (oil, size, flavor, etc.)

In an effort to assess the potential of hazelnut as an oilseed, Lane et al. (2012) found the nut oils to be predominantly oleic acid (a monounsaturated fatty acid). Overall, nut kernels from wild American hazelnut were found to be approximately half the size of the nut kernels from seedling

interspecific hybrid hazelnuts and much smaller than Oregon nuts sold in-shell. Flavor assessment was planned for 2014.

Meeting Goal 4: Provide outreach to growers

Through collaboration between Minnesota, Iowa and Wisconsin, an Annual Midwest Hazelnut Growers Conference was held four times. Several extension publications have resulted from this effort (reports available at http://midwesthazelnuts.org/research.html). Multiple field tours have also been offered.

DISCUSSION

With increased interest in North American for hazelnut products, the potential for increased demand for hazelnut seems high. For example, Ferrero recently opened a hazelnut processing plant in Ontario to serve the North American market. Whether American hazelnut could meet a portion of this demand is still an open question. American hazelnut is at a much earlier stage of domestication than the European hazelnut (50 years of formal breeding efforts have been invested into European hazelnut, Mehlenbacher 1991). While much of the knowledge gained from European hazelnut research efforts can be applied to American hazelnut selection, potentially speeding the plant development process, the plant itself has been subject to a very different anthropogenic dispersal patterns when compared to European hazelnut. Historic transportation of propagules in Europe produced wide dispersal of genetics (T. Molnar, personal communication, March 2, 2013), resulting in centuries of human selection for "desirable traits" that can be capitalized on in current breeding efforts. Indeed, until recently, the backbone of the hazelnut industry in North America was the result of the selection of chance seedlings (Mehlenbacher 1991). Whether anthropogenic selection occurred with American hazelnut in North American pre-history is unknown; however, if selection did occur, the resulting genotypes are not currently available. For these reasons, American hazelnut selections will likely not be available until the end of the decade at the earliest.

Propagation does not appear to be a barrier for the species as a whole. While micropropagation has been successful and predictable with one of our initial selections, one other selection has been unsuccessful under the same protocol. At this stage, the technique is still in development. Mound layering has worked in initial tests with both wild plants and interspecific hybrids in production fields. Pilot scale tests on managed beds are planned for 2014. A combination of micropropagation and mound layering would be expected to be able to provide clonal plant materials for use in commercial plantings.

Increasing grower interest in the Lake States may help push this from a cottage industry to a more significant commercial enterprise. Outreach to these potential and current growers is essential to aid in the development of this industry. At this point, one of the main constraints is availability of genetics. Commercial breeders have been supplying seedling hybrids, but have yet to delivery commercial clonal varieties. While there appears to be commercial potential for these seedlings under some conditions (Fischbach and Braun 2012), further genetic improvement would likely be required to improve the financial viability of the operations. With woody crops, this is often a slow process.

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