

# **AGROFORESTRY: A PROFITABLE LAND USE**

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# A NEW HAZELNUT DEVELOPMENT PROGRAM IN THE LAKE STATES

Mike Demchik<sup>1</sup>, Brent McCown<sup>2</sup>, Jason Fischbach<sup>3</sup>, Anthony Kern<sup>4</sup> and Eric Zeldin<sup>5</sup>

<sup>1</sup>College of Natural Resources, University of Wisconsin Stevens Point

<sup>2</sup>Horticulture, University of Wisconsin Madison

<sup>3</sup>University of Wisconsin Extension

<sup>4</sup>Northland College

<sup>5</sup>University of Wisconsin

Contact: mdemchik@uwsp.edu

**Abstract:** Hazelnut is an intriguing new crop for the Lake States, suited for use as an oilseed and as an edible nut. Several researchers and hobby breeders have attempted to develop this crop for the Lake States with some current small-scale commercial adoption; however, the crop is still in its infancy. A group of researchers, extension specialists and growers are assisting in the development of a hazelnut industry in Wisconsin and Minnesota. Activities include 1) aiding farmers in selecting plant material from existing plantings of seed origin hybrids for their use or broader adoption, 2) screening wild American hazelnut for high-performing plants for use by breeders or as potential crop plants, 3) developing clonal propagation methods and 4) providing outreach activities to those currently growing and those interested in growing hazelnuts. We plan to discuss our results to date emphasizing clonal propagation research and the protocols and results of the screening program for wild American hazelnuts.

**Keywords:** Polycropping, multicropping, alley cropping, agroforestry

## INTRODUCTION

Preliminary work with American and hybrid hazelnuts (*Corylus* spp.) has demonstrated the potential of hazelnut as a perennial oil crop suitable for widescale production in the Upper Midwest and as a possible replacement for the input-intensive annual oilseed crops. Average yields of the top producing accessions of hybrids have reached 1369 lbs kernel/ac on well-managed plantings in Minnesota (Fischbach et al., 2010a). The highest yielding hybrid hazelnut selections in a 5200 plant planting in Nebraska produced an equivalent of 3562 lbs/ac of in-shell nut (1175lbs kernel/ac) (Hammond, 2006). Oil yields from the top 25 producing plants yielded an equivalent of 892 lb oil/ac, nearly twice that of soybeans (Xu et al., 2007) and grown without supplemental fertilization or water. Hazelnut oil has numerous characteristics which make it better suited for oleochemical applications than soybean oil (Xu et al., 2007). For these reasons, hazelnut has been identified as a preferred oilseed crop for development of cold-climate biofuels for use in engines such as jet airplanes (Lane, personal communication).

American hazelnut (*Corylus americana*) is native to Wisconsin and is a dominant shrub species

in much of Northwest Wisconsin. It is found on a wide range of soils, particularly on the sands of Central and Northwest Wisconsin. Native American hazelnut populations at 24 unmanaged and wild locations were screened for high-yielding plants in 2010, with the top ten plants averaging 607 lbs kernel/ac (Fischbach et al., 2010b). The oil content of the kernel ranged from 55-65% (Lane, personal communication), suggesting oil yields from top selections of American hazelnut, in naturally occurring stands can approach 395 lbs oil/ac, compared to average oil yields of 430, 690, and 740 lbs oil/ac for intensively managed soybean, canola, and sunflower.

Domestication of American hazelnut through selection of high-yielding genotypes and production in hedge-row systems has the potential to provide a lower-input and higher-yielding oil crop for Wisconsin with unique adaptation to the nutrient poor and excessively drained sandy soils of Northern, WI.

For this project, we are using a fully integrated approach. The objectives of this projects were to: 1) aid farmers in selecting plant material from existing plantings of seed origin hybrids for their use or broader adoption, 2) screen wild American hazelnut for high-performing plants-for use by breeders or as potential crop plants, 3) develop clonal propagation methods and 4) provide outreach activities to those currently growing and those interested in growing hazelnuts.

## METHODS

At the time of writing, this project is still being completed, so this article should serve as an “intermediate report”. We hope to present more complete information at a future conference.

**Meeting Objective 1:** Currently, several breeders are producing hybrid hazelnuts in the Upper Midwest. The majority of hybrid hazelnuts planted in Wisconsin are seed origin, and thus, highly genetically variable. For existing hybrid plantings, an on-line data collection system was developed to allow growers to collect data on high-producing plants for potential future use in clonal propagation. This system was named the Hazelnut Improvement Program (HIP) and can be viewed at <http://midwesthazelnuts.org/about-hip.html>. Additionally, ten of the largest hybrid hazelnut plantings in Wisconsin were visited each year to estimate growth and production of hybrid hazelnuts.

**Meeting Objective 2:** Wild American hazelnut sites were located across a wide area of Wisconsin. In total, 24 sites met qualifications for selection in year 2010. On these sites, 100 plants were screened using visual selection criteria cards and the top 10 were selected. All nuts were collected from these plants and yield of kernels was estimated from this sample. The top yielding plant from each site was selected for future testing.

**Meeting Objective 3:** Both mound layering (described at [http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2015\\_stool%20bed%20layering%20American%20hazelnut.pdf](http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2015_stool%20bed%20layering%20American%20hazelnut.pdf)) and micropropagation techniques were attempted with American hazelnut.

**Meeting Objective 4:** The creation of an Annual Midwest Hazelnut Growers Conference, several extension publications and workshops has provided a wealth of information to potential and current hazelnut growers.

## RESULTS

**Objective 1:** Use of the HIP website is increasing. For two of the largest hybrid hazelnut plantings that we visit every year, we have collected yields and estimated current yield potential. More information on potential yields is available at [http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2017\\_hybrid%20hazelnut%20yields.pdf](http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2017_hybrid%20hazelnut%20yields.pdf). For the grower entered data and the other younger plantings, most of the plants are too young to allow for a strong selection effort yet.

**Objective 2:** Using data from these wild sites, we have made selection of potentially high-productivity hazelnuts. We have used this data to estimate potential yields of these plants under wild conditions. More information on this assessment is available at [http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2016\\_American%20hazelnut%20yields.pdf](http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2016_American%20hazelnut%20yields.pdf). We would expect management in an orchard setting to significantly increase yield; however, we do not yet have any data for wild American hazelnut grown under managed conditions.

**Objective 3:** We have had some initial success with both techniques (mound layering and micro-propagation); however, we have not proven the potential in a commercial setting or with more than a few clones at this point.

**Objective 4:** Both offerings of the Annual Midwest Hazelnut Growers conference have been well-attended. Seven hazelnut extension publications have been prepared and are available at <http://midwesthazelnuts.org/research.html>. Numerous grower workshops have also been delivered across the state.

## DISCUSSION

The development of woody perennial crops is a very slow process. The use of participatory plant breeding techniques, where the growers select high-productivity plant materials from their own orchards has shown a great deal of potential. As to whether this potential will result in new varieties, we do not yet know. Our wild selections show a great deal of promise. However, until we propagate all of them and plant them in replicated field trials, we will not know their true potential. At this point, the potential yields look very exciting.

Our clonal propagation efforts demonstrate the potential for at least a percentage of the plants to be propagated conventionally. Mound layering has produced clonal material from some genotypes of

both wild and hybrid hazelnuts. There appears to be a great deal of genetic variability in the potential of a plant for mound layering. Micropropagation has worked for two initially tested clones at this point. Current work for this 2011 growing season will test the field performance of such micropropagules and how applicable these protocols are for a wider range of genotypes. As this project is still relatively new, we hope to report on additional findings at later conferences.

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