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Screening Wild Populations of American Hazelnut in NW Wisconsin for High Yielding Plants

Hazelnut Improvement Program

Jason Fischbach—UW-Extension Agriculture Agent
Dr. Mike Demchik—UW-Stevens Point
Kelsey Brasseur—UW Extension Hazelnut Research Assistant

Photo 1. In-shell hazelnuts harvested from *Corylus americana.*

Introduction

Commercial hazelnut production is currently limited to the Pacific Northwest and Mediterranean countries and is based on the European (*Corylus avellana)* and Turkish (*Corylus colorna*) hazelnut. Neither will grow reliably in Wisconsin due to poor winter hardiness and lethal susceptibility to an endemic fungus, eastern filbert blight. The genus *Corylus* is represented in Wisconsin by the beaked hazelnut (C. *cornuta)* and the American hazelnut (C. *americana*). Both occur throughout Wisconsin, with the center of *americana* distribution in the sand country of NW Wisconsin.

Private breeders have been crossing the four species (particularly C.*avellana* and C. *americana*) to combine the nut size and yield of the European with the winter hardiness and disease resistance of the American. The hybrids have shown promise for conditions in the Upper Midwest and a number of projects are in place to screen the hybrid populations for superior genotypes.

Photo 2. NW Wisconsin is home to extensive stands of American hazelnut (*Corylus americana)* such as shown here in the Moquah Barrens. A mass-selection screening program is underway to find high-performing plants for potential commercial hazelnut production.

Despite the wide distribution and high populations of American hazelnut in Wisconsin, little has been done to screen the populations for high-yielding plants. Given the population size, it is possible genotypes suitable for commercial hazelnut production in Wisconsin can be found without expensive and long-term breeding programs.

In 2009, researchers with the Wisconsin Hazelnut Research Team initiated a screening program to look for high-yielding plants for further evaluation in replicated performance trials.

The Quest for Cultivars in Our Own Backyard

American hazelnut is a common understory plant in Wisconsin's forests and often a weedy species that can interfere with oak and pine regeneration, particularly on sandy soils in Northwest Wisconsin. In the fall of 2009, we identified 8 publically-owned sites in Bayfield and Douglas County with dense and vigorous stands of hazelnut. At each site, 100 of the highest yielding plants based on a visual assessment were tagged and marked with GPS. The height and number of nuts were measured for each plant. In 2010, we re-evaluated each site plus an additional 16 sites (Table 1). At each site, nut yield was estimated for each of 100 high-yielding plants using visual yield assessment photos. The ten plants with the highest visually-assessed yield were then tagged and marked with GPS. For each of the ten plants, we measured height and width and harvested all the nuts. In the lab, we measured total number of clusters, total number of nuts, and oven dry weight of the in-shell nuts. After drying, a random ten nut sample for each plant was shelled and weighed to determine kernel yield.

Photo 3. Hazelnuts are found in clusters and are covered with fleshy involucres.

The First Round of Select Hazelnut Accessions

Total kernel yield was calculated by multiplying % kernel from the 10-nut sample by the total in-shell yield. To rank yields within a site, kernel yield per square foot was calculated for each plant by dividing total kernel yield by the surface area of the bush at its widest point. The extrapolated per acre yield was calculated by multiplying the kernel yield per square foot of each plant by 0.5 acres. The ideal spacing for domesticated wild plants is unknown, but a 15' row and 6' plant spacing is commonly used for plantings of hybrid hazelnuts, resulting in roughly half of the planting occupied by the hazelnut shrubs and the other half by row-middle.

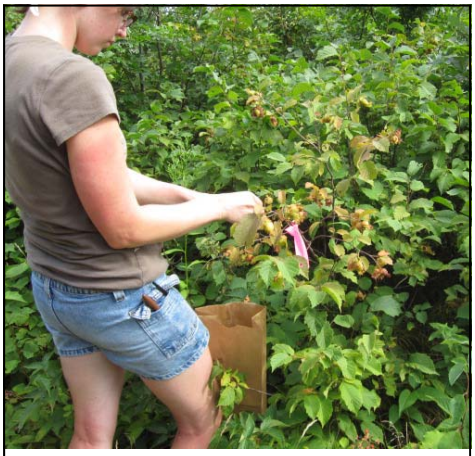

Photo 4. To find high yielding hazelnut plants at each site, 100 plants were visually assessed for yield, and the nuts were harvested from the ten plants with the highest visual yield scores.

Table 1 shows the per plant kernel yield and the extrapolated per acre yield of the highest yielding plant at each of the 24 sites. The average yield of all harvested plants was 20.8 g kernel/plant or 2.9 g kernel/sq ft. The highest yielding plant from all the plants sampled was 147 grams of kernel. Adjusted for plant size, the highest yielding plant had 20 g kernel/sq ft. The average yield of the top plant at each site was 7.1 g kernel/sq ft or 341 lbs kernel/acre and the average yield of the top ten plants sampled across the 24 sites was 12 g kernel/sq ft or 607 lbs kernel/acre.

Replicated performance trials will be necessary to directly compare yields of these wild plants with the hybrids. However, for comparison, researchers in Minnesota working with on-farm plantings of hybrid plants report a 4-yr average per plant yield from the top ten plants at a sandy site of 0.43 lb kernel/plant and a loamy site of 1.98 lb kernel/plant. Assuming a plant density of 484 per acre, these average per plant yields extrapolate to 208 and 958 lbs per acre, respectively.

In 2010-2011, the top two plants from each site will be propagated and the clones planted in replicated performance trials. The replicated plantings will allow a direct comparison of the select material, as well as a better understanding of the environment-genotype interactions of each plant. The screening of wild American populations will continue in 2011.

To better understand the genetic diversity within and between populations of American hazelnut, Dr. Anthony Kern of Northland College in Ashland, WI is conducting a genetic diversity analysis with molecular markers.

Table 1. 2010 Kernel Yields of American Hazelnut From 24 Locations in Northern Wisconsin

Plant ID	Site	County	Kernel Yield* (g/plant)	Kernel Yield** (g/sq ft)	Kernel Yield*** (lbs/ac)
1	Kurtz	Adams	28.7	8.3	399.1
A18	FSR 416	Bayfield	9.7	3.8	181.2
B45	M. Barrens	Bayfield	10.1	5.7	274.1
M48	Currey Rd.	Burnett	8.9	11.3	544.7
N26	Killer Hazel II	Burnett	11.7	12.7	609.5
P92	L. E. Refuge Rd.	Burnett	20.3	3.2	154.9
R55	L. Hildas Corner Rd.	Burnett	62.0	5.2	247.7
S77	Main Dike Rd.	Burnett	35.5	20.1	965.4
L53	Monson Lake	Burnett	6.0	4.9	235.6
O29	U. E. Refuge Rd.	Burnett	68.6	10.9	523.6
Q28	U. Hildas Corner Rd.	Burnett	12.4	11.6	559.8
J61	Crooked Lake Rd.	Douglas	25.7	9.8	469.1
I54	Flat Lake Rd. LT	Douglas	11.3	6.4	308.3
F104	H. Town Hall	Douglas	20.1	18.8	904.0
G25	HTH NCT	Douglas	8.1	1.5	74.4
006	Killer Hazel^	Douglas	40.2	N/A	N/A
K60	S. Coppermine Rd.	Douglas	18.1	5.8	277.3
D34	Samples RD NCT	Douglas	4.7	1.2	56.6
E90	Samples RD SS	Douglas	11.6	7.3	352.7
10	Jun	Juneau	57.5	6.0	287.6
3	Demchik****	Portage	11.3	0.3	14.1
3	NG	Waushara	1.5	0.019	0.9
1	Wood A	Wood	33.5	1.2	57.0
8	Wood B	Wood	100.6	8.0	385.1

* Kernel yield (g/plant) = total in-shell oven dry weight x % kernel

** Kernel yield (g/sq ft) = kernel yield/surface area of the plant at its widest point

*** Kernel yield(lbs/ac) = kernel yield (lbs/sq ft) x 43560/2

****Demchik and NG sites experienced nut weevil damage, reducing kernel yields

^ Top plants selected based on total harvested nuts (no width data)

This project is a collaborative effort of the Wisconsin Hazelnut Research Team.