Growers and Researchers Working Together to Develop Hazelnut Cultivars for the Upper Midwest

HAZELNUT IMPROVEMENT PROGRAM
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Last Updated: March 10, 2010

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Hazelnut Improvement Program
Program Description

Congratulations! By choosing to participate in the Hazelnut Improvement Program (HIP) you have chosen to engage in the noble science of plant breeding. By collecting data on your best hazelnut plants you are helping to develop a valuable perennial crop with potential to greatly improve the quality of our surface and groundwater, soil, and agricultural ecosystems. Who knows, someday, you might have a hazelnut cultivar named after you, your kids, or your sweetie!

About the Program
The HIP program was started in 2009 by researchers with the University of Wisconsin and University of Minnesota seeking to assist Midwest hazelnuts growers in identifying superior hazelnut plants and developing locally-adapted cultivars for commercial hazelnut production. The program depends on growers collecting data on their plants and freely sharing the information with researchers and other growers. Over time, the hope is to use the data to identify superior plants for further evaluation, breeding, and possible cultivar development.

Why is the Program Necessary?
As of 2008, there was an estimated 16,000+ hybrid hazelnut plants in Wisconsin alone, and each one of them genetically unique. The reason they are genetically unique is because the vast majority of hazelnut plants sold to growers originate from seed. This contrasts sharply with every other commercial fruit and nut crop.   Apples, for example, are reproduced and sold as grafted clones. Every "Honeycrisp" apple tree is genetically identical, all having originated from a single tree in an orchard in Minnesota.

This diversity in the hazelnut population is both a challenge and an opportunity. Having a population of unique plants in a planting means that each plant has a different height, each plant has a different ripening time, each plant has a different size nut, and on and on. Some diversity within a planting is good, but too much makes it difficult to have a commercially viable enterprise. On the other hand, all the hazelnut diversity on the landscape means there are likely superior plants that yield well, have a large nut size, are disease tolerant, are vigorous and easy to grow, taste good, and/or are easy to harvest. The problem is we don't know where they are and we don't know if the superior plants are superior due to their genetics or are superior due to the nice soil in which they are growing.

No single person or group of people could possibly evaluate all the hazelnut plants in our region, thus, to find the plants with superior traits, growers, themselves, need to do the looking and HIP is designed to help.

What's the Long-Term Plan for HIP?
The goal over the next two years is to train growers how to evaluate their plants and enter the data into the on-line database. As the number of growers participating in the program and the number of plants entered in the database increases, it will be possible to compare, contrast, and identify plants that have excellent traits such as large nut size, EFB resistance, excellent vigor, early-yielding, consistent yielding, heavy yielding, uniform ripening, insect resistance, nice plant form, etc. The next step will be to vegetatively propagate those high-quality plants through stem cuttings, mound layering, or some other suitable propagation technique and plant them in replicated performance trials at multiple locations to determine whether the plant truly is superior or is just growing in a nice spot. This process has already begun to a limited extent and HIP will identify more plants faster. If the high-quality plants prove to be high-quality

in the replicated performance trials then the next step might be to pursue cultivar development and/or to use the plants in controlled crosses.

A very important goal of HIP is to maintain genetic diversity. The intention from the beginning will be to develop, over the long-term, many different locally-adapted cultivars. The more growers that participate and the more plants that are evaluated the more likely HIP will produce cultivars for all regions and growing conditions.

How Much Time Do I Have to Commit to the Program?
The beauty of HIP is that you can dedicate as much or as little time to the program as you want. You can measure and enter data on every plant in your planting, or you can measure and enter data on just one plant. How much time you put into HIP is completely up to you.

How Old Do My Plants Have to Be?
You can start measuring and entering data on plants in the year after planting. Plant height, plant width, year of first flowering, year of first nut production is all great information to have that you can start collecting right away. Consistent nut yield is probably the most important trait, but it is entirely possible that a plant that turns out to be low-yielding, but flowers very early or has excellent flavor, could be an important parent in a controlled cross. So, regardless of how many plants you have or how old they are you are welcome and encouraged to participate in HIP.

OK, Sounds Good, How Do I Get Started?

Start a Grower Profile
This part is not required, but if you want, you can create a Grower Profile about yourself and start a blog that describes your hazelnuts and how you're growing them. Go to the Grower Profile page of www.midwesthazelnuts.org to learn more. The Grower Profile is intended to help growers learn from each other.

Step 1. Do a Rough Screening of Your Planting
The first step to HIP is to do a very rough screening of your hazelnut planting to identify which plants you think are worthy of measuring and collecting data. This rough screening can be done a million different ways, and a couple of options are listed below. Choose the one that works best for you…

Option 1. Measure Every Plant
For those of you with relatively small plantings and time to spare, you can measure and enter data on every plant. If you choose this option, your next step will be to label every plant. See the Labeling section below to learn how.

Option 2. Measure The Plants That Look Good to You
Every hazelnut planting has a few plants that really stand out for one reason or another. If you don't have a lot of time, you might just pick the five best plants or ten best or whatever number you have time for and measure and enter data on only those plants. As the planting matures and you learn more about the plants, you might decide to drop some plants or add new ones to your top five or top ten list. If you choose this option, your next step will be to label your top plants. See the Labeling section below to learn how.

Option 3. Accumulating Flags
Another good method to screen your plants is to walk your entire planting periodically and tie a piece of flagging on plants that stand out. This method is particularly useful for young plantings that haven't

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started bearing nuts, but can be used with older plantings as well. In the second and third year after planting you might find a few plants with catkins or nuts. Tie a flag on each of these plants. Starting in the second year after planting, walk your planting in July of each year and flag the most vigorous plants and walk the planting again in August or early-September and flag the plants with the most nuts or the largest clusters. Ideally, your flags should be color coded so you know why that plant was flagged. For example, a yellow flag might mean the plant was one of the first to produce catkins, red might mean it is one of the most vigorous, and black might mean it is one of the highest yielding. Do this for a couple of years and the plants with the most flags are your best plants. You then measure and enter data on those plants. It is important to use flagging that won't be eaten by the deer or the sun. The plastic tape used by florists tends to stick around for many years.

The number of plants that you flag each time you walk the planting depends on how many plants you are willing to measure. Even though, ultimately, you might decide to only measure and enter data on 10 plants, it's a good idea to flag the top 20 or 30 plants for any given trait each time you walk the orchard. For example, you might walk the orchard in July and flag the 20 plants that seem the most vigorous and then walk the orchard again in September and flag the 20 plants with the most nuts. After a couple of years of doing this, you can then choose the 10 plants with the most flags.

You will have to decide when to move from visually assessing your planting with the flag system to collecting real data. There is no steadfast rule for making the switch. One suggestion is to start collecting data from plants that have accumulated 2-3 flags. As time goes on and you learn more about your plants, you might stop collecting data on some plants and add others.

Step 2. Label Your Plants
Once you've screened your plantings and determined which plants to measure and enter data on, you need to give your plant a unique identifier and a tag. The identifier can be any combination of words or numbers, but should be some sort of code that provides some information about the plant. For example, the identifier might have three parts: your initials, the year it was planted, and a sequential number. It might look like this….JF2009001. However, what identifier you give your plants is totally up to you.

It is a good idea to put a tag on the plant. Generally, plastic tags used by tree nurseries don't last very long and metal tags used at arboretums are favorite toys of raccoons and other critters. A simple and highly recommended tag is simply a piece of vinyl siding attached to the plant with a piece of wire. You can write on the vinyl with a plain #2 pencil and the label will last for many years. Another option are the thick metal circle tags sold by Gemplers, Forestry Suppliers, or other such retailers. You can scratch an identifier on the tag or use the number already on the tag.

In addition to a plant tag you should have a map and labeling system for your plantings, so that you can find your plants in the event the plant tag disappears. The method preferred by Badgersett Research Corporation and others is to drive a piece of rebar at the beginning of each row and use the distance from the rebar as the plant's number. For example, if a plant in Row A was 15 feet from the rebar, the plant would be labeled, "A15". You could add your initials and the year of planting to that identifier to get: "JF2009A15".

When you enter the plant into the HIP database you will use this identifier to identify your plant.

Step 3: Create a HIP Account
The next step is to create a HIP account at www.midwesthazelnuts.com by clicking on the "Enter Hip Data" tab. Download the Data Entry Guide for complete instructions.

Step 4: Start Collecting Data

Once you've created a HIP account and figured out which plants you want to measure and collect data from, you are ready to start entering data into the on-line database. Download the Data Entry Guide for complete instructions. The database is arranged into four sections: Contact Info, Planting Information, Plant Information, Plant Performance. The sections are nested and to enter Plant Performance information you must first complete the Plant Information section and to enter Plant Information you must first complete the Planting Information section.

Who Can See My Contact and Plant Data?

By participating in HIP you are agreeing to work with University of Wisconsin and University of Minnesota researchers in identifying and developing hazelnut cultivars suitable for the Upper Midwest. As such, any data you enter will be available to the HIP researchers listed in the Privacy Policy. The data will be used by the researchers to better understand growth and yield characteristics of the hazelnut plants and to help identify high-performing plants for further evaluation. In addition, the data may be compiled for research reports. Individual data will not be released or published. Please download the HIP Privacy Policy for more information.

When you create a HIP account you will be asked if you want to share information you enter in each of the four database sections with other growers. If you choose yes to any of the sections, information you enter in those sections and only those sections will be listed in the "Shared Information" section of the website. Anyone with a HIP account will be able to see that information. If you do not want to share your contact information with other growers, but you would like to share plant performance information, than you would only check the "My Plant Performance" box.

You are not required to share your information with other growers, however, being able to compare your plants to others around the region will give you a better idea of how your plants are doing.

Hazelnut Improvement Program
Data Collection and Entry Guide

> **This guide provides instructions on how to create an on-line HIP account, collect data from your hazelnut plants, and enter it into the on-line database.**

The Hazelnut Improvement Program (HIP) database is arranged in 4 sections: Grower Contact Information, Planting Information, Plant Information, Plant Performance Information. When you first access the HIP database you will be prompted to create an account. The directions below will help you do so.

Create an Account (Contact Information) This information will be used by the HIP Research Team to contact you about your hazelnut plants. If you choose to share this information with other growers, it will be a way for other growers to contact you about hazelnuts.	
First Name:	Enter your first name
Last Name:	Enter your last name
Address 1:	Enter your street address or PO Box
Address 2:	If you need more space to enter your address
City:	Enter the city of your mailing address
State:	Enter the state of your mailing address
Zip Code:	Enter the zip code of your mailing address
Phone:	Enter your telephone number
Email:	Entering your email address is required in order for you to reset your password in case you forget it.
User Name:	The user name can be any combination of letters or numbers
Password:	Password must be more than 8 characters and less than 16 containing a combination of lowercase and uppercase characters and numbers.
Confirm Password:	Retype the password
Share the Following Information with Other Growers: See the explanation below:	

All of the data you enter in the HIP database is arranged in one of the following four sections:
- **"Contact Information":** This section contains all of the information you enter when you create an account.
- **"Planting Information":** This section contains all of the information you enter about your planting(s) of hazelnuts. See My Planting Information below.
- **"Plant Information":** This section contains all of the information you enter about your hazelnut plant(s). See My Plant Information below.
- **"Plant Performance":** This section contains all of the information you enter about the performance of your hazelnut plant(s). See My Plant Performance below.

Check the boxes to share the information in those sections with others that have a HIP account. For example, if you want to share your plant performance information, but don't want other users of the website to see whose plants they are or where they are planted, check the "Plant Performance" box, but none of the others. Please read the HIP data-sharing and privacy policy document for more information. Regardless of which boxes you check, the HIP research team will be able to view all the entered data.

My Planting Information **Use this section to enter information about the planting of hazelnuts. This information will provide important environmental information about where the hazelnut plants are being grown and how they are being managed.**	
"Planting Identifier":	Enter a name, number, or other unique identifier for a group of plants that were planted in the same year at the same location and are managed more or less the same way.
"State":	Enter the State in which the planting is located.
"County":	Enter the County in which the planting is located.
"Town":	Enter the Town in which the planting is located. This is a name such as "White River".
"Township":	Enter the Township in which the planting is located, such as 55N.
"Range":	Enter the Range in which the planting is located, such as 4W.
"Section":	Enter the Section in which the planting is located, such as 13.
"Soil Type":	Choose the soil type from dropdown menu that most accurately describes the soil in which the planting is located. If there are multiple soils within the planting, either choose the soil type that most accurately describes the predominant soil type or split the planting by soil type and create a Planting Information entry for each planting.
"Soil Series":	Enter the NRCS soils series name or number for the planting as listed on an official NRCS soils map. Soil series names for any place in the United States can be found at: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
"Previous Crop":	Choose the previous crop from the dropdown menu that most accurately describes what was growing in the field in the year prior to planting the hazelnuts.
"Site Prep":	In 50 words or less, describe what actions were taken to prepare the site for planting. For example, "fall plow, fall disk, spring rototiller, spring pre-emergent herbicide."
"Weed Control":	Choose the method(s) of weed control from the dropdown menu that most accurately describes how you control weeds in the planting.
"Soil pH":	Enter the pH of the soil from the most recent soil test.
"Soil Test P":	Enter the soil test P in parts per million (ppm) from the most recent soil test.
"Soil Test K":	Enter the soil test P in parts per million (ppm) from the most recent soil test.
"Number of Plants in Planting":	Enter the number of living hazelnuts currently in the planting. This number should be updated every so often as plants die.
"Between Plant Spacing":	Enter the plant spacing in feet.
"Between Row Spacing":	Enter the row spacing in feet.
"Fertilized":	Check yes, no, or no answer if the plants have ever been fertilized.
"Fertilizer Details":	If the plants have been fertilized describe what fertilizer was added, how much, and when it was applied.

My Plant Information **Use this section to enter information about a single plant in your planting. This section provides basic information about the plant, but not performance.**	
"Planting":	Choose the Planting from the dropdown menu. The dropdown menu will only list the Plantings entered in the My Planting Information section.
"Plant ID":	Enter a number, name, or unique identifier for the plant. The identifier can be letters, numbers, or any combination of letters and numbers. The identifier should only be used once.
"Year Planted":	Enter the year the plant was planted.
"Month Planted":	Enter the month the plant was planted.
"Species":	Enter the species of the plant if known.
"Cultivar"	Enter the cultivar name of the plant, if known. Most hybrids do not yet have cultivar names.
"Plant Source":	Enter the name of the nursery, plant breeder, or grower from which you obtained the plant.
"Share This Information with Plant Source": Check yes if you want to share the plant performance information you enter for this plant with the person or business you entered in "Plant Source". If you check "Yes" the administrators of this site will send the plant performance information for this plant to the person or company you enter in "Plant Source", upon that person's or company's request. This information is particularly useful for breeders that are trying to better understand how their plants are doing. If you chose to share the "Plant Performance" information in the My Account page, this information will already be accessible to anyone that has a HIP account. See the HIP privacy policy for more information.	
"Seedling Type":	Choose the seedling type from the dropdown menu that best describes the plant when you obtained it from the nursery, breeder, or grower.
"Plant Source ID":	Enter the unique identifier for this plant given to it by the plant breeder or grower, if known.
"Why I'm Entering this Plant":	Chose the reason that most accurately describes why you are entering this plant in the database.
"Year of First Catkins":	Enter the year of the first spring the hazelnut has catkins.
"Year of First Nuts":	Enter the year in which the plant first produced nuts.
"Year of Plant Death":	If the plant died, enter the year it died.
"Cause of Death":	Describe what killed the plant, if known.

My Plant Performance **Use this section to enter performance data for a specific plant. You must first enter the plant in the My Plant Information section.**	
"Plant":	Choose the Plant from the dropdown menu. The dropdown menu will only list the Plants entered in the My Plant Information section.
"Date":	Enter the date the data were collected.

"Plant Height (inches)":	Enter the height of the plant from the ground to the highest point of the plant.
"Plant Width (inches)":	Enter the width of the plant at the widest point of the plant.
"Presence of Dead Stems":	Choose yes or no whether there are dead stems on the plant. This data should be collected during June or July.
"Cause of Dead Stems":	Describe what killed the stems, if known. For example: winter injury, bronze birch borer, rodents.
"Total Number of Clusters":	Enter the number of clusters that are on the shrub. This is one measure of yield potential of the plant.
"Maximum Cluster Size":	Enter the number of nuts in the largest nut cluster. The largest cluster on the shrub is the one with the most nuts in the cluster.
"Total Fresh Nut Crop Weight (husked)":	Collect all nuts from the shrub, husk them, and weigh the in-shell nuts. Enter the number of pounds.

"Average Dried Nut Weight (in shell)": Accurately determining the average nut size for a given shrub requires drying the in-shell nuts to a standard dryness of 6% moisture. Start by randomly selecting 10 husked nuts from the shrub and then dry the nuts. There are two options to dry the nuts to 6%. The first option is to put all the in-shell nuts in a perforated onion bag and hang the nuts in a warm dry place for at least three months. The second option is to send the 10 randomly selected nuts to Mike Demchik at the University of Stevens Point, where he will dry and weigh the nuts for you and send the results to you. Divide the total dry weight of the 10 in-shell nuts a by 10 to get the average weight. Enter this average value in ounces.

To have Mike Demchik dry and weigh the nuts for you, collect the 10 randomly selected husked nuts from the shrub, place in an envelope or box and send to:
Mike Demchik, UW Stevens Point, 800 Reserve St., Stevens Point, WI 54481
Include your contact information.

"Average Percent Kernal":	Once you have dried the 10 nuts, carefully separate the kernals from the shells and weigh both components separately. Divide the total kernal weight by the total in-shell weight of the 10 nuts and enter the percentage of the dried weight that is kernal.
"Average Percent Shell":	Once you have dried the 10 nuts, carefully separate the kernals from the shells and weigh both components separately. Divide the total shell weight by the total in-shell weight of the 10 nuts and enter the percentage of the dried weight that is shell.
"Pellicle Present":	The pellicle is the thin papery covering between the shell and the nut. It is usually a brown or tan color. Enter yes or no if the pellicle is present.

Hazelnut Improvement Program
Privacy and Intellectual Property Management Policy

General

By creating a HIP Account through the www.midwesthazelnuts.org website and entering data on hazelnut plants, the user agrees to share any and all entered data with the Hazelnut Improvement Program Research Team (HIPRT). The HIPRT will use the data to better understand the quantity, geographic distribution, and performance of hazelnut plants entered in the HIP database. The HIPRT may use the data to generate research reports or other compilations, but the HIPRT will not release or publicize individual contact, planting, plant, or plant performance data without express written consent from the individual.

Shared Data

Any grower entering data into the HIP Database has the option to share data within each of the four database sections via the My Accounts page. By checking "Yes" to any of these sections, data within that section will be publicly available to anyone that has a HIP Account via the "Shared Information" tables. The HIPRT cannot be responsible for anything done with the Shared Information data.

Sharing Data with Plant Suppliers

When a grower agrees to share plant performance information with the Plant's Supplier via the "My Plant Information" section of the database, the grower agrees to release all information to the plant's supplier for that plant entered in the "My Plant Information" and "My Plant Performance" sections of the database, as requested by the plant supplier. The HIPRT cannot be responsible for how the plant supplier uses that data.

Further Evaluation of High-Performing Plants

When plants are identified by the HIPRT as potential high-performing plants, the plant's owner will be contacted about propagating the plant for further evaluation in replicated performance trials. If the plant's owner agrees to participate the owner will be asked to sign a standard "Hazelnut Material Evaluation and Propagation Agreement". This agreement states that growers retain ownership of any plant material they supply to the HIPRT through the evaluation stage. If the HIPRT determines that it has no long-term value for germplasm improvement, the HIPRT will either return the plant(s) to the grower or destroy it. If the HIPRT determines that it does have value for germplasm improvement efforts, then ownership becomes shared between the grower and HIPRT, with terms to be agreed upon by both parties at that time. This ensures that the grower has a right to a portion of any royalties that the HIPRT receives from the improved material, while enabling the HIPRT to retain enough of the royalties to support further plant improvement efforts. In the event the plant is located in a replicated performance trial on a collaborator's farm not under the direct control of the HIPRT or HIPRT

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institutions, the farm owners will be required to sign an agreement agreeing to not propagate the plant.

Hazelnut Improvement Program Research Team (HIPRT)

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