

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 early-adopters of Midwest hazelnuts 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 originated 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 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 and contrast and identify plants that have excellent traits such as large nut size, 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 really nice spot. This process has already begun to a very 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 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 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.

Option 4. The Fancy Pants Method

This method is for folks that like to do things thoroughly. This is the cadillac of the screening options and is complicated enough that it requires a lengthy explanation and diagram. The method is similar to Option 3, but instead of accumulating flags you accumulate letters and write them on a plant tag and/or plant map. It requires that you visually assess your plantings to

identify the top 10% for four key traits: precocity, vigor, number of clusters, and cluster size. The method is best used for plantings that have not yet flowered and the evaluation starts in the year after planting. See the diagram at the end of this document for more information.

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.

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, then 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.

On-Farm Hazelnut Breeding Screening Tool

This screening tool is intended for growers that do not have the time or resources to collect data on all their hazelnut plants. The tool helps growers identify the plants with characteristics justifying measuring and recording plant performance data. The tool is based on visual observations to identify the top 10% of plants for precocity, vigor, number of clusters, and cluster size.

When a plant is first tagged, the label should start with a sequential number, starting at "001". See the example below. In addition to a tag, the plant's location should also be mapped, in case the tag is lost.

A plant at John Doe's farm that had catkins in year 2 and 3, ranked in the top 10% for vigor in year 3 and 4, did not rank in the top 10% for # of nut clusters, and ranked in the top 10% for nut size in year 5 and 6 would have the following label at the end of Year 6. The plant was planted in 2005 and was the first to receive a tag.	001JD06FFVBB
--	--------------

Plant Characteristic	Plant Age	Screening	Labelling Instructions	Plant ID	Data to Collect from Plants with IDs
	Year 1 (Planting Year)	None			Year Planted, Month Planted, Species, Cultivar, Plant Source, Seedling Type, Source ID(if known)
Precocity	Year 2	Look for catkins in the spring and label all plants with catkins.		Affix a tag with plant number, grower's initials, last two digits of the year, and the letter "F".	Year planted, plant height, plant width, number of clusters, maximum cluster size, average nut weight, percent kernel weight, percent shell weight, presence of dead stems
	Year 3	Look for catkins in the spring.....	If less than 10% of plants have catkins than label plants with catkins as for Year 2 If more than 10% of plants have catkins than label the most vigorous plants with catkins, but do not label more than 10% of total plants	For previously unlabelled plants, label as explained above for Year 2. For previously labelled plants add another letter "F" For previously unlabelled plants, label as explained above for Year 2. For previously labelled plants add another letter "F"	
Vigor	Years 3-4	Evaluate all plants in mid-June and label the most vigorous plants. Do not label more than 10% of the total plants.	If the plant already has a label....	Add the letter "V" to the label.	
			If the plant does not yet have a label....	Affix a tag with plant number, grower's initials, last two digits of the year, and the letter "V".	
Number of nut clusters	Year 4-7	Evaluate all plants immediately prior to harvest and label the plants with the most nut clusters. Do not label more than 10% of the total plants.	If the plant already has a label....	Add the letter "N" to the label.	
			If the plant does not yet have a label....	Affix a tag with plant number, grower's initials, last two digits of the year, and the letter "N".	
Nut size	Year 5+	Evaluate all plants during harvest and label the plants with the largest cluster size as measured by nuts per cluster. Do not label more than 10% of the total plants.	If the plant already has a label....	Add the letter "B" to the label.	
			If the plant does not yet have a label....	Affix a tag with plant number, grower's initials, last two digits of the year, and the letter "B".	

Screening Tool Instructions:

The tool works by first identifying a plant as being a top performing plant for precocity, vigor, nut yield, and nut size and then accumulating "letters". Plants with the most letters represent the superior plants in the planting. Furthermore, regardless of how many letters are accumulated by the plant, any tagged plant may have characteristics making it desirable in a breeding program. For example, a plant with large nut size might not be anything special for precocity, nut yield, or vigor, but could be an important parent in a breeding program.

Performance data should be collected on all tagged and labelled plants, however, as time goes on, growers may choose to only collect performance data from the plants with the most letters. Performance data should be recorded and kept in a safe place and/or entered in the HIP on-line hazelnut breeding database, hosted by the University of Wisconsin.

