

# Growing Hybrid Hazelnuts

Lois Braun<sup>1</sup> & Jeff Jensen<sup>2</sup> Version 3, Jan. 2015

This publication is intended to be a modest introduction to growing hybrid hazelnuts. Virtually all plantings in the Upper Midwest are best described as research plantings. Ranging from conservation plantings to orchard plantings in old cow lots, the situations and circumstances are as diverse as the growers. Much of the information is based on the experiences of the authors, as well as first-hand accounts and interviews with other current growers. There is much to learn about growing hazelnuts successfully in the Midwest; the following is what we have learned so far.

## What are Hybrid Hazelnuts?

Hybrid hazelnuts are crosses between the European hazelnut *Corylus avellana*, which was bred for large nut size and which is the basis for the commercial hazelnut industry in Oregon; and the native American species, *Corylus americana*, which brings winter hardiness and disease tolerance to the mix.

Unlike the European hazelnuts, these hybrids are grown as multi-stemmed bushes, not as trees. This is important because it reduces their maintenance costs at the same time as increasing their ecological value to the landscape. These contributions include reduced soil erosion, improved water quality, improved wildlife habitat, and reduced inputs. In addition, they can provide a favorable economic return to the farm family. Although still in their infancy as a commercial crop, hybrid hazelnuts have huge potential and are likely to play an important role in diversifying the landscape of the Upper Midwest.

American hazelnuts have an extensive native range, from Manitoba to Georgia and from the East Coast to North Dakota. Hybrid hazelnuts can be grown in many situations

for a variety of reasons. Multi-functional conservation plantings such as living snow fences, home windbreaks and field shelterbelts provide significant ecological benefits, all while producing a crop. Because they do not require annual tillage, and because they may be grown with perennial cover between rows, hazelnuts are an ideal crop for highly erodible land. All of these situations provide much needed habitat for wildlife, including for beneficial insects such as pollinators, thereby increasing diversity on the landscape.

Efforts are currently underway to commercialize hybrid hazelnuts as a new crop for the Upper Midwest. To be widely adopted, plants must be relatively uniform, have a structure conducive to machine planting & harvesting and have desirable nut traits. To achieve these goals, researchers are focusing on improving and developing the following:

1. Genetics and propagation techniques,
2. Agronomic recommendations for growing hazels,
3. Harvesting and processing technology,
4. Value-added products and markets.



*Hybrid Hazelnuts do not have the large nut size of the European Hazelnut.*

## Uses and Markets



*University breeders are selecting hybrid hazelnuts with thinner shells than American hazelnuts, for ease of cracking.*

Currently only 20% of the hazelnuts consumed in the United States are produced in this country; the remaining are imported from overseas. Thus, there is a large un-met market demand, which is likely to grow as new hazelnut products are developed. American consumers are most familiar with hazelnuts as a component of gourmet party nut mixes, coffee flavoring, and in decadent chocolates, but they can also be an ingredient in a range of baked and convenience foods, in sandwich spreads similar to peanut butter, and as a milk substitute. Demand is projected to grow as people become more aware of the health benefits of eating nuts: they are high in vitamins E, B-6, fiber and in monounsaturated fatty acids, which help reduce the risk for heart disease. New research points to several phytochemicals in hazels that protect against cancer.

Hazelnuts have a high oil content. They are 50% to 60% oil by weight, with de-fatted hazelnut meal as a co-product of the oil crushing process. The oil and meal have market potential in human food, animal feed, cosmetics, flavoring, and much more. End uses include:

- Food/baking – Hazelnut oil is almost identical to olive oil, one of our healthiest cooking and salad oils.
- Cosmetics – Hazelnut oil is great for the skin, either straight (with users reporting little “oily” residue) or as an ingredient in lotions, balms, and ointments.
- Bio-diesel/lubricants – Hazelnut oil has a favorable oil profile for use as biodiesel and as a lubricant.

The market potential of hybrid hazelnuts is currently undeveloped in the Midwest. The initial market is likely to be in kernels, oil, meal, and other processed products, because hybrids do not produce the large nuts favored by the in-shell market or for fancy nut mixes. This means that value-added processing will be required to enter these markets.

As of January 2015 no commercial hazelnut processors exist in the Midwest for cracking or further processing in-shell nuts. Many individual growers have purchased or developed small-scale equipment for sizing, cracking, separation, etc., but as yet there is no integrated processing line. Efforts are underway by several growers and groups to develop a processing line, which when built, will remove the primary bottleneck to producing the quality and volume needed to gain access to markets.



*Hybrid hazelnut kernels ready to eat. (The spoon is a teaspoon.)*

## Establishment

### *Site Selection*

Hybrid hazelnuts may be grown on marginal land not conducive to row-crop production, such as sites with poor soil, highly erodible slopes or fields that are too small for row crop equipment. Hazelnuts do best on well-drained, deep, and fertile soil, but they have also done well in soils ranging from heavy clay to sand, with pH from 5.0 to 7.5 and higher. Targeting hazelnuts to marginal lands, which are often the most environmentally sensitive parts of the landscape, may be a way of reaping an economic return from this land without contributing to further environmental damage. Sites that should be avoided include land that is close to woodlands, which provide habitat for marauding squirrels, true riparian areas with saturated soils (hazelnuts do not like wet feet), and land with exceedingly compacted soils, though this can to some extent be alleviated by subsoiling before planting.

### *Layout*

The ideal layout of a planting depends on objectives, time and money. Mature bushes may be up to 12 feet tall and nearly as wide, but it may take up to ten years or more to attain these sizes. To develop a closed hedgerow quickly, such as is desired for living snowfences, shelterbelts, and windbreaks, within-row spacing may be as close as 4 ft. between plants. Although this increases costs for planting material, it allows faster canopy closure. For production plantings, a wider spacing of 6 to 9 feet within rows might be better for sunlight penetration, which is important for good yields.

Between-row spacing depends on what kind of equipment will be used to mow the vegetation between rows. We recommend the width of the equipment plus an additional two to four feet to allow for bush growth. Ten feet used to be recommended, though many growers now wish they had gone with wider rows. Some growers alternate 10 or 12 foot rows with 15 or 16 foot ones to ensure access. Annual crops, such as vegetables, may be grown between rows to maximize economic returns during establishment years. It is also advisable to plant on a grid to make cross-mowing possible if that is part of your weed control strategy.



*An 11 year old hazelnut planting, spaced on a 10 by 10 foot grid. This planting has become difficult to work in because it is too crowded.*

### *Soil Preparation*

Because you can expect your hazelnut planting to live and be productive for well over fifty years, the expense of good site preparation will pay off over the long run. Several months before planting, the soil should be tested for P, K and pH, because these nutrients are most effective if incorporated into the soil and therefore amending them is easier before planting than after. Amend soil P and K levels according to recommendations for other fruit crops, such as grapes, given in the U of M Bulletin “Nutrient Management for Commercial Fruit and Vegetable Crops in Minnesota” (BU-05886). Although hazelnuts are tolerant of low pH, it is advisable to apply lime if pH is below 5.6, using rates recommended for your state. Use dolomitic lime to supply magnesium if soils test lower than 100 ppm magnesium, for magnesium deficiency has been suspected in some plantings.

It is essential that perennial weeds, such as other woody vegetation, brambles, and quackgrass, be eliminated before planting hazelnuts, ideally the year before. This cannot be overemphasized. The anticipated longevity of the planting justifies the cost. Perennial weeds can be eliminated with a burn-down spray of glyphosate (Roundup™), followed by plowing a few weeks later, followed by an additional spray of glyphosate after that to kill any regrowth. For growers who wish not to use herbicides, repetitive tillage can do the same job: plow, and then plow again when regrowth is observed. It may be necessary to hand remove fragments of rhizomatous roots that may regrow. The down-side of repetitive tillage that it destroys soil organic matter, may cause soil erosion, and may stimulate germination of annual weeds.

If no perennial weeds exist, plowing may be unnecessary, especially if planting plants with small root systems by hand. However, planting (especially backfilling the planting holes) is much easier with a well-worked and loose planting bed, especially if following sod. This is especially important with bare-root planting material. If the subsoil is compacted, subsoiling is recommended. Again, the anticipated longevity of the planting justifies the cost. Two passes are recommended, one in each direction down the planting row, followed by another operation to smooth the surface. In any case, it is never necessary to till the alleys between rows except in the case of potentially noxious perennial weeds. By leaving the alleys untilled, erosion is better controlled.

### ***Planting Material***

Currently, the only commercially available planting material is from open pollinated seed, which is inherently highly variable. Research is underway to develop commercially viable methods of vegetative propagation, which will enable nurseries to supply highly uniform plant material, but that is not available yet. Mound layering is an option for vegetative propagation on a small scale if you, or a friend, already have some desirable hazelnut plants. A bulletin “How to Mound Layer Hazelnuts” is available at [www.midwesthazelnuts.org](http://www.midwesthazelnuts.org).



*This 7-month old seedling was grown in a one-gallon pot. Its roots were only moderately pot bound and were easily disentangled. (The veins of small yellow beads are Osmocote slow-release fertilizer added to the potting mix.)*

There are two types of seedlings currently available: containerized and bare-root dormant. Containerized seedlings may be sold in a variety of size pots or tubes, and are usually three to seven months old. They are usually actively growing; that is, they still have their leaves on. Transplanting survival is usually better with seedlings grown in pots large enough for adequate root growth. Their main stems should be from ¼ to 3/8 inches in diameter at transplanting. If you purchase small “tubelings” we recommend that you transplant them into larger pots to grow them larger before transplanting them in the fall, since fall is the best time to transplant all “leaf-on” material. Spring and summer-transplanted material must contend with summer drought and often stops growing entirely for the remainder of the season, which may stunt their growth permanently. September into early October is usually ideal for transplanting because it is cooler, but it is also early enough that roots have a chance to become established before winter.

“Bare-root dormant” refers to plants that are shipped in a leafless condition without potting mix around their roots. They may be seedlings that were grown in an outdoor seedbed, or containerized plants that were taken out of their pots after they shed their leaves in the fall; or they may be clones produced by mound layering. Bare-root dormant plants may be planted either in the fall or in the spring before they break dormancy. We recommend fall transplanting because soil conditions are usually better in the fall, whereas in the spring the soil is often too wet to

work. Aiming for fall transplanting also offers room for error. If you purchase plants in the fall but for some reason are unable to get them transplanted into their permanent locations, you can “heel them in” for the winter: plant a bundle of plants together in a trench, then dig them up before they break bud in the spring for proper transplanting.

### ***Some General Thoughts on Transplanting***

- For all kinds of planting material, make holes as close as possible to the same size and shape as the container or root system.
- Don't Plant Too Deep!! Holes should be dug only deep enough for the top of the root ball to be at ground level or just slightly below.
- Transplant in cool overcast weather or late in the day to prevent moisture stress to the transplants.
- Water seedlings immediately to remove air pockets and to get good soil-root contact.

### ***Planting Bare Root Dormant***

- Layers tend to have broad and shallow roots, sometimes as wide as two feet while only 4 inches deep. A well-tilled planting bed facilitates making the broad shallow holes needed to accommodate them and is also essential for getting the fine soil needed for back filling around bare roots. Garden rakes work well if the soil is loose.
- Never let the roots of bare root dormant plants dry out. Keep them in a bucket of water or buried in moist packing material while transplanting.
- Plant layers like asparagus, with the roots pointing out and downwards from the crown. Avoid letting the roots criss-cross or point upwards at the tips.

### ***Planting Containerized Seedlings***

- Untangle encircling roots while transplanting. If these are not disentangled they will continue to grow inward, instead of growing out into the soil.
- If you cannot untangle them, simply cut them with a sharp knife or shovel blade. The damage done is not a problem if they are vigorous to start with. Point these roots outward in the bottom of the planting hole.
- Scrape off the top half inch of potting mix and replace it with half an inch of field soil. This is because some kinds of the soil-less potting mixes used in the containers tend to act like a wick, drawing moisture away from the young plant if it is exposed to the air.
- If seedlings still have nuts attached, remove them before planting, because nuts attract rodents that may dig up the seedlings in search of the nuts.



## Maintenance

### *Weed Control*

Research shows that young woody plants of all kinds do better with good within-row weed control. A weed-free area of about 1 to 1 ½ feet around each plant is essential, but maintaining a completely weed-free planting strip may be easier to manage, depending on your resources. Otherwise, cross-mowing is needed to keep the short young plants from becoming hidden in the tall weeds in the spaces between plants within the rows. Fortunately, once hazelnuts are well established, after about three years, they can compete adequately against most weeds on their own, and little more than mowing is needed.

In small plantings weeds can be controlled by hand, by pulling or careful hoeing of weeds. A sharp hoe that can shave off weeds at ground level is most effective and will not damage hazel roots. If weeds are hoed when they are very small, hoeing is not as much work as it seems, though it must be done three or four times a year, starting early in the season.



*Landscape fabric and mulch were placed over drip tape to suppress weeds and conserve moisture in this new planting. A grass cover crop was planted between rows.*

A three to four inch thick layer of woodchip mulch offers the dual benefits of suppressing annual weeds (for up to two years after application) and conserving soil moisture. However, woodchips can provide habitat for bark-eating mice so it should be kept two to three inches away from the plant stems. However, woodchips are not very good at suppressing perennial weeds, which simply grow through it, which is why it is a good idea to eliminate perennial weeds before planting. Very careful spot applications of glyphosate (Roundup™) to perennial weeds that grow through the woodchips can keep them under control, but avoid getting the glyphosate on the hazelnuts. Another problem with woodchips is that, depending on their source, they may harbor weed tree seeds. Ask where they came from first, to be sure that they did not come from trees that were bearing mature seed at the time they were cut. If not sure, it is best to use woodchips that have been sitting for a year.

Good quality landscape fabric provides nearly complete weed control, except for weeds that grow up through the planting hole, where they can really crowd the young hazelnut transplant. It is difficult to pull these weeds without also pulling out the transplant, so they should be clipped instead. The durability of landscape fabric is highly variable; it should be good enough that it lasts for the two to three years required for hazelnut establishment, but not so durable that it doesn't break down after that. Otherwise it either inhibits growth of new stems or forces new stems to grow on the outside of the fabric strip, forming a thicket that is hard to manage. Black plastic mulch is not recommended.

For very large plantings, mechanical weed control has been found to work, either with a regular row-crop cultivator or with specialized equipment for tree plantations, such as a Weed Badger™, but these require good pre-plant tillage. Herbicides can be used, but require extreme care to avoid getting it on the hazelnuts.

In the alleys between rows it is desirable to either plant cover crops or allow native vegetation to grow for soil erosion control and other ecological benefits. Cool season plants and low-growing legumes, such as clover, are

best since they are less likely to compete for moisture with the hazelnuts. Warm season grasses should be avoided. Alleys can be maintained with mowing.

Weed tree seedlings can be a challenge throughout a hazelnut planting's lifespan, because they are often mistaken for young hazelnut suckers. Keep an eye out for seedlings of whatever species of seed-bearing trees grow nearby. The best management for these is vigilance: pull them as soon as you see them. It is a good idea to walk your planting once a year in the fall after leaf drop. Young tree seedlings tend to retain their leaves longer than mature plants, so they are most visible in the fall after the hazelnut leaves are off. If the soil is moist and they are still small, they can be pulled. Otherwise they will need to be cut and the stumps treated with a stump killer immediately after cutting. This is best done by two people: one to cut, and the other to paint on the herbicide with a brush or squirt bottle.



*A University of Minnesota trial to compare different methods of weed control, including woodchips, landscape fabric, hoeing, and herbicides. Planting strips in this former hayfield were prepared either with tillage or a burn-down spray of Glyphosate.*

### ***Watering***

Maintaining adequate moisture in the root zone during the first two years is critical to hazelnut survival. Irrigation may enhance the productivity of mature bushes as well, though this needs to be researched. We recommend half an inch per week, if not supplied by rainfall; an inch may be needed in droughty soils. Many growers use water wagons. Inexpensive drip tape is more efficient and has successfully been used by some growers. If woodchips are available, a three to four inch layer of woodchip mulch may entirely eliminate the need for watering in many years, depending on soil type.



Photo: Dave Hansen

## Fertilization

Assuming that P and K were applied before planting, the main nutrient to be concerned about is nitrogen (N). The N requirements of young hazelnuts are so low that fertilization is not usually needed in the first two years except in soils with less than 3% organic matter. After the second year, N requirements increase with increasing size of bush according to Table 1, unless soil organic matter exceeds 4.5%, in which case apply none.

**Table 1.** Recommended-N rates for hybrid hazelnuts in the Upper Midwest for the first three years after transplanting.

Year	N to Apply	
	oz. per square foot of bush spread	grams per square meter of bush spread
1 (establishment year)	0	0
2	0 – 0.04	4
3	0 – 0.08	8

For large plantings measure several bushes and average them; multiply the amount needed per bush by number of plants per acre to get N application rate per acre.

For mature bushes, N recommendations are based on leaf analysis in combination with observations of their vigor and yield. Low leaf N alone does not indicate N deficiency if bushes are growing and producing well. But if growth is sluggish and or leaves are pale, suspect a nitrogen deficiency and send leaf samples in to a lab for analysis. Collect 20 to 30 leaves from a bush in late July, taking the top-most fully expanded leaf from each of 20 to 30 stems, and apply N based on Table 2:

**Table 2.** Recommended rate of N fertilizer to apply to established hybrid hazelnuts in the Upper Midwest based on leaf N concentration.

% leaf N		N to Apply	
		oz. per square foot of bush spread	grams per square meter of bush spread
< 1.9 %	Severely deficient	0.17 – 0.25	16 - 47
1.9 – 2.1	Slightly deficient	0.08 – 0.17	8 - 16
2.1 – 2.5	Optimal	0 – 0.08	0 - 8
> 2.5	Excessive	0	0

Choose the lower end of the range if plants are vigorous, and the higher end of the range if they are not.

Nitrogen fertilizer is most efficiently taken up when conditions are good for growth, when the plant has most use for it. Thus it is best to apply N under conditions of good soil moisture any time from May through August. Later applications are not harmful to the plants, but are more likely to be leached out of the root zone and to become environmental pollutants. Slow release forms of N fertilizer, such as tree stakes, Osmocote, commercial fertilizers treated with nitrification inhibitors, or organic manures, including leguminous cover crops, are likely to minimize environmental losses and increase N uptake efficiency.

Keep in mind that no amount of N will solve a problem caused by deficiency of other nutrients. Besides N, P, and K, other nutrients that may be deficient in hazelnuts include Boron, Zinc and Magnesium.

Recommendations for these can be found in the Oregon nutrient management guide for hazelnuts available at <http://horticulture.oregonstate.edu/system/files/u1473/em8786-e.pdf>

## *Insects and Diseases*

Currently hybrid hazelnuts have no insect or disease problems of sufficient concern to merit control. Whereas European hazelnuts are highly susceptible to a lethal disease, Eastern Filbert Blight (EFB), our native American hazelnuts co-evolved with this disease and are naturally tolerant or resistant to it. Most of the hybrid hazelnuts grown in the Midwest inherited this tolerance/resistance from their native American hazelnut parents. Although some branches may become infected, EFB rarely kills the whole plant, because these multi-stemmed bushes just grow replacement stems, though EFB may significantly reduce yields.



Photo: Tom Molnar

*EFB lesions appear as strings of 1/2 to 3/4 inch diamond-shaped black pustules on older stems.*

Bronze birch borer and longhorn beetle are two insects that kill branches by girdling them when they lay their eggs, but they are not considered significant problems. Big bud mite (BBM) is another significant pest. This microscopic mite colonizes leaf buds, causing them to enlarge but preventing the emergence of their leaves. Genetic resistance to big bud mite is being selected for.

## *Other Pests*

The biggest pests of hazelnuts are mammals and birds. Rabbits, deer, mice, pocket gophers, and others have all been known to nibble on hazelnut leaves, stems and roots, if only out of curiosity. Although the seedlings can tolerate a little grazing, too much can decimate a new planting. The type of protection that is best depends on what kind of animal is likely in your environment, and your own preferences. Deer fences, mesh cages, spiral tree wraps, and repellants, including a home-made egg spray, have all been found to be useful depending on the circumstances. (Details on the egg spray can be found on the Badgersett website.) Although grazing control is generally needed only through the first season or two, pocket gophers can kill plants up to five years of age and should be controlled with trapping or poison in their burrows.

At harvest time, squirrels, mice and birds, such as crows and blue jays, can be significant problems. Hawk roosts and various systems for scaring them away are necessary because these animals can run away with your harvest just as soon as it ripens. Timely harvest is critical, because most animals can detect the moment the nuts are ready and waste no time in beating you to them. Squirrels are especially a problem because they don't wait for nuts to be ripe. Thus squirrels may warrant extra control measures, such as year-round trapping.

## Harvest

Hazelnut bushes will usually produce their first nuts in their fourth year, though they will not come into full nut production until year eight or later. Hazelnuts start to mature in late July in parts of Iowa; further north harvest is typically from mid-August through mid-September. Nuts should be harvested just as soon as they become loose in their husks to avoid losses to predation. In some plants this may occur when the husks are still green and moist, whereas in others it may not be until they are brown and dry. In general, if the clusters can be pulled from the bushes easily, they are ready to harvest.

Currently most hazelnuts in the Midwest are harvested by hand, but a few growers have pooled their resources to purchase a mechanical blueberry harvester. This machine straddles the rows and knocks mature nut clusters from the branches, leaving immature ones for later harvests. Mechanical harvest will become more efficient when vegetatively propagated cultivars become available, with more uniform and predictable maturation dates.

## *Post-Harvest*

If the nut clusters were picked while the husks were still green and moist to avoid predation by squirrels, they need to post-ripen for a week in conditions of high humidity but with adequate light and air circulation. Under a sprinkler in a greenhouse or other protected location is one possibility. If the husks were starting to turn brown at harvest time they should be allowed to dry completely. Options include spreading them out in a well-ventilated but mouse- and squirrel-proof location, hanging them in mesh onion bags, or placing them in a crop dryer at a low temperature until completely dry.

The next steps are to husk and shell the nuts. Small quantities can be husked by hand; larger quantities can be husked with a variety of home-made implements that involve beating the clusters to break the husks, followed by cleaning them with an old fashioned seed cleaner. Prototypes of commercial huskers have been developed and await commercialization. Likewise with shelling equipment: a variety of home-scale shellers are already available. The industry is waiting for a sufficient volume of production to make production of these machines worthwhile for the manufacturers.

## Other Considerations

### *Pollination*



Photo: Roy Cerling

*A catkin, a male flower, starting to elongate to release yellow pollen in the early spring.*

Hazelnuts are wind pollinated, and bloom very early in the spring, before leaf-out. In the Upper Midwest they can bloom from mid-March into mid-April. The male flowers, called catkins, start developing on plants in June of the year prior to blooming, and persist on the plants through the winter. They are extremely cold hardy, but lose their hardiness in the spring when they start to expand to release their yellow pollen. An untimely frost can kill them, though this is not a huge problem in seedling plantings where plants are blooming at a wide variety of different times.

The female flowers occur on the tips of buds and cannot be seen until they start to open. Even then, they are so small that they can be missed unless you are looking for them. The pistils may be red or pink, or occasionally white when receptive to pollen, but turn black after they have been pollinated. Two or so weeks after pollination the pistillate buds start to elongate into new leafy shoots, with the developing nut clusters on the tips of the stems not becoming visible until June.

Hazelnuts are self-incompatible. That means that hazelnuts cannot pollinate themselves, but must be pollinated by another plant of a different variety. That means that a planting must consist of at least two different varieties, preferably more, because for cross pollination to occur plants must bloom at the same time. The more different plants there are the more likely there is to be overlap of bloom period. Poor pollination can be a significant barrier to good yield, especially when plants are young and not yet producing many catkins. This is less of a problem with larger plantings.



Photo: Roy Cerling

*Female flowers appear as tufts of pink, red, or white, sticky pistils on the tips of buds.*

## ***Coppicing***

After about twelve years, hazelnut bushes will often become overly large for easy harvest, with declining yields. They can be rejuvenated by coppicing them to the ground during the winter when they are dormant. They should re-grow vigorously, and be back to full production in about three years. Coppicing can be accomplished with a chain saw, a bush hog, or with equipment for harvest of woody biomass crops, such as for hybrid poplar or willows. The coppiced material can be used for biomass energy. Coppicing does not have to be done on a planting all at once, but can be rotated through a planting over several years to spread out labor requirements and to ensure some harvest every year.

There are three methods of removing a hazelnut planting, though we hope you won't ever want to. Coppicing alone will not kill them, but coppicing followed by immediate application of a systemic herbicide to the stumps will kill them, though it may take repeated applications. A slower method is to coppice them repeatedly until they deplete their stored root reserves. Or they can be yanked out of the ground with a tractor and chain.

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For additional information on hazelnuts and 3<sup>rd</sup> crops in general, please contact **Rural Advantage**:

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[www.ruraladvantage.org](http://www.ruraladvantage.org)

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For more information about hybrid hazelnuts in the Upper Midwest, go to [www.midwesthazelnuts.org](http://www.midwesthazelnuts.org)

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## Hybrid Hazelnut Production Timeline

	Year	Activity	When	Inputs Required
<b>Site Preparation</b> (Year before planting or early in planting year)	<b>0</b>	Eliminate existing vegetation	When convenient	Roundup and sprayer, or tillage equipment
		Soil test. Apply P, K and lime as needed.	When convenient	Soil test, P, K, lime and application equipment.
<b>Establishment</b>	<b>1</b>	Pre-plant tillage or sod burn-down	May - June or late Aug - early Sept	Roundup and sprayer, or tillage equipment
		Lay landscape fabric if planned.		Landscape fabric and landscape fabric laying machine if a large planting. (Note that for plants with large root balls, landscape fabric must be laid down <u>after</u> planting.)
		Planting		Hand-tools (shovels, rakes) or mechanical transplanter.
		Watering (1/2 - 1 inch/week)	Immediately after planting into early fall.	Water wagon, drip hose, or drip tape.
		Within-Row Weed Control	As needed through growing season (usually 3-4 times)	Hoe, or mulch, or landscape fabric, or row-crop cultivator, or herbicides applied with a wick system or sprayer with a shield.
		Between-Row Weed Control	As needed through growing season	Mower
		Herbivore control	Immediately after planting through winter, especially in winter.	Fences or cages, repellents, bait, traps, etc.
<b>Growing Years</b>	<b>2 - 4</b>	Continue watering, within-row weed control, between row mowing, and herbivore control, though with diminishing intensity as plants grow and can better fend for themselves.		
	<b>2</b>	Leaf Sampling	Late July	Send to a lab.
	<b>3 - 5</b>	Fertilize	May - Aug	Fertilizer and application equipment.
<b>Maturation</b>	<b>5 - 11</b>	Continue mowing and fertilization as above.		
		Nut predator control	Summer	Erect hawk roosts etc.
		Harvest.	Mid-Aug to mid-Sept	Buckets, bags, and lots of labor, or mechanical picking device.
		Dry, husk, shell and sell nuts!	When convenient (Winter)	Lots of labor or mechanical huskers, cleaners and shellers.
<b>Coppicing</b>	<b>12</b>	Cut bushes down.	Dormant season (Nov-March)	Sickle-bar mower, brush cutter, etc.
<b>Regrowth</b>	<b>13</b>	Relax! (and mow)		
	<b>14-23 26-35 etc.</b>	Continue watering, weed control, mowing, leaf sampling, fertilizing, and harvesting as above.		