Current Research on New Hazelnut Varieties in British Columbia

Thomas E. O'Dell and Haley Argen
Nature Tech Nursery, Langley, BC
thom.odell@gmail.com

"When we develop an agriculture that fits this land, it will become an almost endless vista of green, crop-yielding trees." -J. Russell Smith, Tree Crops: A Permanent Agriculture, 1950

I. Background and Brief History of Hazelnuts on the West Coast

Nature Tech

We started Nature Tech Nursery in 2010 in part to help revive the hazelnut industry in British Columbia by importing new varieties that combine disease resistance with substantial yield increases. We will briefly review hazelnuts as a crop and the BC industry, talk about the new varieties, and discuss agroforestry applications of hazelnut trees.

Hazelnut Species

Our focus is the cultivated hazelnut or filbert, *Corylus avellana* of European ancestry, because of its long history of selective breeding and superior crop value. You may have heard of Barcelona and Ennis of the older varieties or Jefferson and Yamhill of the new. There are three additional kinds of hazelnuts native to North America: the American Hazelnut (*Corylus americana*; original host of eastern filbert blight (1)), the Beaked Hazel (*Corylus cornuta*) and the California Hazel (*Corylus cornuta var. californica* or just *C. californica*); all certainly have agroforestry potential and are used in ecological restoration. Many efforts are underway to develop hazelnut trees suitable to a wider range of conditions, often by hybridizing Eurasian and North American species (e.g. 'Trazels'). Below we refer to the main hazelnut of commerce, *Corylus avellana.*

Development of the Industry

Globally, most hazelnuts are grown in Turkey where they produce over 600,000 tonnes per year. Hazelnut trees were brought to California in the 1880's and large orchards were established in Oregon by the 1890's. Oregon currently produces most of North America's hazelnut crop, but only about 5% of the world harvest. "The average farm-gate value (net value of hazelnuts when they leave the farm after marketing cost) of the U.S. crop in the past three years was about $63 million, with a processed value of nearly $160 million." (2)

A commercial hazelnut crop in the Fraser Valley dates to at least the 1930's and BC was home to a North American pioneer of nut tree breeding: David Gellatly Jr., who lived on Okanagan Lake. The remnant of his orchard, where he bred north hardy nut varieties from 1905 through the 1960's, is a Regional Park and working Heritage farm (3). Credit for the development of the hazelnut crop here in the lower mainland of BC in the 1980's goes in good measure to Henry Wigand, who tirelessly promoted the industry and started the processing plant that is now Canadian Hazelnuts (4). By 2000, there were over 800 acres of hazelnut trees in the Fraser Valley producing over 300 tons of nuts per year, mostly around Chilliwack and Agassiz. Then, eastern filbert blight (EFB) arrived.

Eastern Filbert Blight (EFB)

EFB is native to eastern North America where it lives, without causing disease, on the native *Corylus americana* and where its destructive effects on the cultivated hazelnut varieties has so far prevented their adoption as a commercial crop. EFB arrived in Oregon in the 1970's, where it wrought havoc on the hazelnut industry, and made it to BC around 2003. Many commercial hazelnut orchards in BC now have the blight; some have been cut down, others are dying, most are still productive.

In Oregon, some orchards have continued commercial production even with blight present for twenty or more years. Management strategies include reducing infection through aggressive pruning and spray programs. However, planting resistant varieties is probably the best long-term strategy. Before we get into the new, resistant varieties, you should know a few more things about the blight.

Different hazelnut varieties can be more or less susceptible to EFB but the newly released varieties from the Oregon State University breeding program are all highly resistant, even to many strains of EFB found in the East. However, EFB has many strains or races and it so far appears that few of these strains are present in the Pacific Northwest. If more strains of the disease arrive, the risk of infection increases and the disease organism has more opportunity to evolve and overcome plant defenses. Currently there is a quarantine preventing importation of hazelnut trees to British Columbia except in sterile culture. It is important to keep this quarantine in place to slow the spread of the disease (5).

New Varieties

Oregon State University in Corvallis hosts a large collection of hazelnut varieties with an active breeding program since 1969 (6), applying classic selective breeding to produce superior nut trees. The past 10 years has seen the release of many of new hazelnut varieties selected for EFB resistance and nut or pollen characteristics. Some new varieties can produce almost double the yield per acre of the old standard Barcelona (7). This shouldn't surprise anyone, the Barcelona hazelnut variety is over 300 years old; four decades of selective breeding has led to substantial improvements.

Oregon hazelnut growers made this breeding work possible by providing about $4 million from a per ton assessment for research over the past 25 years, with additional funding from the USDA. The newest ones are patented, with license fees going to support the continued research. The breeding program now delays release of new varieties outside of Oregon for at least three years as an additional benefit to the growers who funded the work.

By creating new varieties with high resistance to EFB, the OSU breeding program is widely credited with rescuing the hazelnut industry in Oregon, which currently grows by about 3000 acres per year. They continue to select for varieties with improved qualities such as better flavour; OSU released three more varieties in 2012 and we hear that more are on the way.

Because hazelnuts are obligate out-crossers, two different varieties are required for nut production, and grower's plant 10-20% of each orchard with several varieties of pollenizer trees. Pollenizers have to be genetically compatible with the select nut variety and the pollen has to shed at the time when female flowers are receptive. Timing of pollen shed and female flowering differ between varieties and change from year to year. The recommendation is to have two or three compatible pollenizers in every planting to release pollen over the entire flowering period for maximum nut production. It is also why the current variety trial is so important: just about all existing information is from Oregon and the behavior of each variety may change when planted at a more northerly latitude.

The BC Hazelnut Variety Trial

Hazelnut farmers, the BC Hazelnut Grower's Association (BCHGA), the Investment Agriculture Foundation (IAF) and Nature Tech Nursery are partnering to compare six new hazelnut varieties at six locations in the lower Mainland and Gulf Islands of BC. All of the sites were partially planted with the new trees over the past two years and the last planting will be finished this spring. We will measure timing of flowering and pollen shed and nut production for the next several years. Since the nut harvest can coincide with the onset of fall rains, harvest dates are also being evaluated. Interested growers will soon have local data to inform their decisions about planting hazelnuts in southwestern BC. In addition to producing the trees for this project, Nature Tech Nursery provides scientific support to collect and analyze data and communicate the results. We look forward to presenting more information about the hazelnut variety trial as it becomes available.

II. Using Hazelnuts in Agroforestry

What is Agroforestry?

"Agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy, and sustainable land-use systems." (8).

So when trees are used on a farm by design to produce a crop of fruit or nuts, with the space under or between the trees used for forage, alley cropping or other production, that is a kind of agroforestry.

Why Hazelnuts?

There are few places in the world as suitable to hazelnut orchards as the Fraser Valley. Hazelnut trees require winters that are fairly mild to facilitate pollination (which tends to peak in January or February) yet cold enough to provide adequate chilling of about 1600 hours below 7° C. While they prefer well-drained soil, they can tolerate a wide range of soil conditions and they benefit from being well-watered. Hazelnuts fall from the trees in September or October (depending on the variety and the season), are swept into windrows with a mechanical sweeper and a harvester picks them up. They are then cleaned and dried before sale or processing. Dried hazelnuts store well for up to a year at room temperature.

The nuts are delicious, nutritious and healthful, rich in protein and unsaturated fats with significant amounts of B and E vitamins, calcium and cholesterol-reducing phytosterols. Most nuts are used in candy but other opportunities for value-added products are endless (dry roasted nuts, nut butter, flour, oil, cosmetics, etc.). Currently most BC Hazelnut growers are part-time, partly because hazelnuts are a relatively low input, low labour crop well suited to people with small acreage who want to grow food for supplemental income and farm tax status. Local hazelnut farmers have benefitted from the Canadian Hazelnut processing facility in Agassiz and Eagle View Hazelnut Processors in Chilliwack and many commercial orchards are in that area.

While hazelnuts are the only commercial nut crop in BC and have many advantages, there are some challenges to a vibrant BC hazelnut industry. They are generally considered hardy to Zone 5 US, though this can vary by cultivar and some varieties may survive in the Peace River area (3). In addition to the Lower Mainland and coastal islands of BC, older varieties are known to be hardy and produce nuts in some areas of the Okanagan, around Kamloops and Nelson, and most of the new cultivars we are trialing in BC have been successfully grown in the the zone 6 area around the Niagara Peninsula of southern Ontario. The area of potential success for the new cultivars in BC is unknown, since each cultivar and microclimate is different, and they have not been widely planted here (almost all current data is from Oregon).

Locally, there is a limited and aging infrastructure for processing and marketing hazelnuts; however, it is not presently used to capacity because production appears to be declining with the spread of EFB. There has been little to no supply in BC of hazelnut trees for planting (or re-planting) for the past ten years. Therefore, in some ways we are trying to establish what amounts to a new crop. In addition, while some new varieties have been imported, in the future we can expect a three-year delay plus license fees on new releases. Finally, while hazelnuts can be profitable, so far they have not yielded the value per acre that berries do (9) and with the high cost of land farmers have opted for the highest returns. We are optimistic that the increased yields of the new varieties, together with the volatility of blueberry prices, will lead to diversification of local agriculture with more nuts grown.

How Can You Use Hazelnuts in Agroforestry?

Hazelnuts can be planted in traditional orchards, with intercropping, used in livestock pasture, hedgerows, windbreaks, for shading farm buildings, as hosts for truffles, and of course for the many other benefits (e.g. habitat, shade) that come from adding more kinds of trees on your farm.

Orchards typically are planted with 18 x 18 or 20 x 20 foot spacing (109 to 134 trees per acre). Some farmers plant at double-density (9x18 or 10x20) to increase yields. This is especially valuable for increasing yield early in orchard development and trees are transplanted successfully up to about ten years. The ‘extra’ trees can be transplanted to additional acreage with little delay in production. Some nut production can occur 3 to 5 yrs after field planting, commercial harvests begin at 5 to 7 years, and production plateaus at ten to fifteen. Yields of the old hazelnut varieties averaged about a ton per acre, but one of the new ones, Yamhill, has averaged 3600 lbs per acre in years eight to ten at an Oregon farm (7). The newer varieties also have higher percentages of nut kernel and fewer ‘blanks’ (empty shells) which increases value.

Intercropping can be very successful with crops such as garlic, squash, and clover seed between the hazelnut trees. With orchards, this works best during establishment - before nut production, when harvests impact the alleys between the rows and the orchard becomes more shaded. Nuts make excellent feed, and some livestock can clean up the nuts left after harvest. Feeding culls to livestock, allowing them to feed from nuts left on the ground after harvest, or growing nuts purposely for feed are time-proven agroforestry strategies.

Hazelnuts are also being touted as an oil or fuel crop in the Midwestern US where the climate is unsuitable to European varieties with large nuts, and the native species are being selectively bred for this purpose. Another innovative idea we have heard is to plant hazelnut trees between chicken houses to provide shade along with a cash crop. Hazelnuts are a traditional hedgerow plant, with the advantage of providing feed. Of course, any tree provides shade, wildlife habitat, and supports various beneficial insects, while helping reduce soil loss and fertilizer runoff.

Looking to the future, there is potential to produce truffles from inoculated hazelnut trees. Truffles are underground mushrooms produced by fungi associated with tree roots. There are hundreds of species of truffles but only about a dozen are harvested commercially. Italian white truffles are the most valuable food crop in the world and the Perigord black is not far behind. The Perigord truffle has been cultivated successfully in orchards of inoculated hazelnut trees (called truffieres) in Europe, the US, New Zealand and Australia. A prize has been offered by the Truffle Association of British Columbia for the first proven European truffle produced in BC. It has yet to be claimed, but several experimental truffieres are in development around the lower mainland of BC; time will tell of their success.

III. Summary

Our passion for growing, tree crops, and hazelnuts in particular, inspired us to start our nursery and we are excited to see the increasing demand for our trees. We view this as not just a business but also a contribution to food security and sustainability, since the surest way to keep a food supply stable and secure is by growing it locally.

Hazelnuts are a high-value, low input crop ideal for BC. Recent variety releases from Oregon State University's breeding program, combining disease resistance with excellent nut quality and yields, are now being grown in BC. Extra maintenance on existing orchard and planting the new disease resistant varieties reduce the impact of EFB, but ongoing diligence in regards to biosecurity and quarantine are also important measures to slow the spread of the disease (5).

Hazelnut trees have many uses and you can probably think of more! Whether you are thinking about an orchard, a hedge, or a few shade trees, it is a good time to consider hazelnut trees to diversify your farm.

Agroforestry is the ancient idea of using trees on the farm. There are so many possibilities for this that we can't begin to list them all, but luckily we don't have to; there are many resources if you need more information including books (10) and web pages (11).

IV. For More information About Growing Hazelnuts

BC Hazelnut Growers Association: email: hazelnuts@shaw.ca, phone: 604-796-2550

BC Ministry of Agriculture: http://www.agf.gov.bc.ca/aboutind/products/plant/filberts.htm

Oregon State University: http://extension.oregonstate.edu/yamhill/hazelnuts-filberts

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