Hybrid Hazelnuts: A Promising Future Crop for Food, Feed and Bioenergy

Scott Josiah, Tom Molnar, Shawn Mehlenbacher, Doug Farrar

Hybrid Hazelnut Research Consortium

Hazelnut Facts

- Called hazelnut or filbert
- Hazelnuts - 5th most important tree nut crop in the world behind cashews, almonds, walnuts, & chestnuts
  - World production = average of 430,000 metric tons (kernel) produced from 2007-12, worth $3.3 billion
- The U.S. produces around 3-4% of the world crop, behind Turkey (70-80%) and Italy (15-20%)
- 99% of the U.S. hazelnut crop is grown in the Willamette Valley of Oregon

Major European hazelnut Production Areas:

- Turkey
- Italy
- Azerbaijan
- Republic of Georgia
- USA
- Spain
- Chile
- others

Hazelnut History in Eastern North America

- Early colonists brought hazelnuts from Europe – commercial production only established in OR
- The native fungal disease Eastern Filbert Blight (EFB) killed most European hazelnut trees in eastern NA
- EFB is naturally occurring on the resistant wild American hazelnut, *Corylus americana*
- EFB & cold temps are the primary reasons there are no commercial hazelnut plantings in the eastern US

Native range of American hazelnut and EFB pathogen

EFB

Hazelnuts as a Sustainable Crop

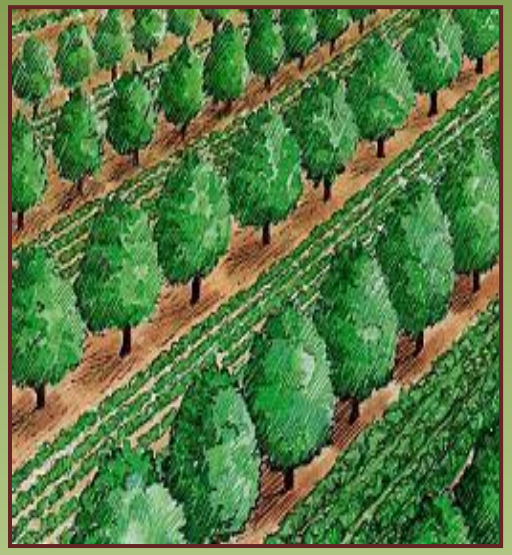
- Woody perennial agriculture
- Socially, economically, & environmentally sustainable
  - Profitable (gross returns ~$3,000-$4,000/ac)
  - Environmentally friendly, low input, low impact crop
    - Reduce soil erosion and nutrient runoff
    - Sequester carbon
    - Provide wildlife habitat
  - Family friendly
  - Produced in orchards or can be integrated into farming systems (agroforestry)

"Productive Conservation"

Hazelnuts can be grown in orchards, or integrated into agroforestry systems, combining Production with Protection

Field and Farmstead Windbreaks

Riparian (streamside) Buffers



Alleycropping

Living Snow Fences

Orchards

Hazelnut Food Markets:

90% of the world crop is used as kernels in candy, baked-goods, and other products

Hazelnut Oil

- Kernel is between 51-75% oil by weight
- Oil applications
  - cooking oil
    - high in oleic and linoleic acids
    - Very similar to olive oil
  - biodiesel & oleochemicals
    - superior to soybean oil
    - better oxidative stability
    - lower cloud point (better flowability at low temps)
    - 2x yield/acre of soybean oil
    - 88% of energy of diesel fuel
  - mechanical lubricant

Hazelnut Meal (after oil removal)

- Meal remaining after pressing high quality, high protein human and animal feed
- Potential substitute for those with wheat/gluten allergies

Horticultural Markets

Market Prospects

- Growing NA demand: Ferraro hazelnut plant in Ontario has quadrupled in size in past 10 years to 24,000 tons/year
- Hazelnuts – major ingredient in rapidly growing market for European chocolate
- Of 86 million Americans who like hazelnut coffee, 75% would like to purchase other hazelnut products
- Hazelnuts are heart-healthy
  - 91% monounsaturated fats
  - Great source of protein & fiber
  - Rich in vitamins E and C
  - Powerful antioxidant qualities
- Substantial room for market growth
  - Americans eat 8 oz/year
  - Europeans eat 2 to 4.4 lbs/year

Barriers to Large-Scale Expansion of European Hazelnut Cultivation

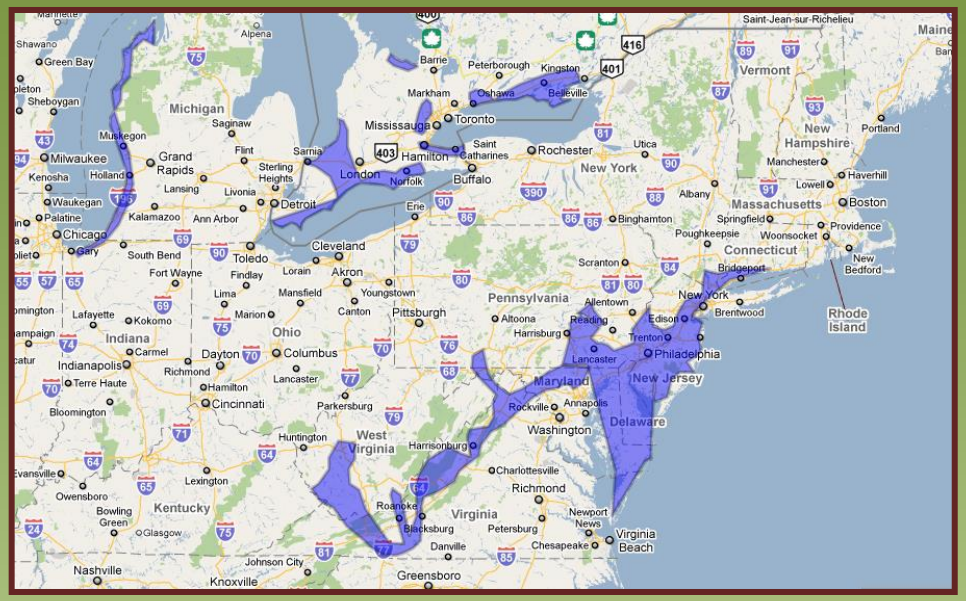
- Susceptible to Eastern Filbert Blight (EFB)
- Lack of cold tolerance
- Phenology mismatched to climate
- Big Bud Mite susceptibility

Eastern Filbert Blight

Fungus - *Anisogramma anomala*

- Nearly all European hazelnuts are highly susceptible
- Fungus grows under bark and creates cankers that kill hazelnut plants
- Native to eastern North America
- First discovered in Oregon's Willamette Valley in 1986
- More than 60 % of Oregon's hazelnut orchards are now affected or in close proximity to diseased orchards

Potential Growing Regions for Hybrid Hazelnuts



Potential Climate Range for EFB Resistant Commercial Cultivars of *European Hazelnut*

Potential Range for EFB Resistant *Hybrid* Hazelnut Cultivars of Commercial Quality

Solution: Develop climatically-adapted, disease-resistant hybrid hazelnuts by crossing European with American hazelnuts. Dramatically expands range for commercial production.

Addressing the Challenge: Hybrid Hazelnut R&D Consortium

Oregon State University

Dr. Shawn A. Mehlenbacher: Lead Hazelnut Researcher/Plant Breeder

- ***DNA Markers, Plant Breeding, World's Largest Germplasm***

University of Nebraska Lincoln

Dr. Scott J. Josiah: NE State Forester and Director, NE Forest Service

- ***Replicated Field Trials, Outreach and Education***

RUTGERS

Dr. Thomas Molnar: Lead Hazelnut Researcher/Plant Breeder

- ***EFB Resistance, Plant Breeding, Germplasm***

Dr. Bradley Hillman: Plant Pathology/Molecular biology

- ***EFB Disease Research***

Doug Farrar, Vice President, Arbor Day Foundation

- ***National Outreach/information dissemination***
- ***Consortium Management and Facilitation***
- ***National network of 100,000+ hazelnut cooperators***

Goals of the Consortium

- To commercialize hybrid hazelnut production within 10 years-
  - "the third crop"
- Develop high yielding, insect and EFB resistant, cold hardy, heat tolerant hybrid hazelnuts of commercial size, taste and appearance
  - Blend EFB resistance and cold hardiness of American and other hazelnut species with commercial qualities of European Hazelnut
- Develop multiple selections adapted to broad climatic zones
  - 14 superior selections now developed for more widespread testing in North America

Consortium Activities: Breeding for the 21st Century

- Plant breeding
  - Plant/kernel characteristics
  - EFB resistance
  - Climatic Adaptation
  - Horticultural applications
- Identifying sources of EFB resistance
- Mapping of *C. avellana, C. americana* and EFB genomes
- Determining location of EFB resistance markers
- Creating rapid diagnostic tools for identifying EFB resistance
- Rangewide collection of *Corylus americana*
- Field testing in multiple locations
- Cultivation & mechanization research
- Developing enterprise budgets
- Education and outreach

	Known EFB-resistant	New EFB-resistant
1. out-group	3	1
2. Asian C. *heterophylla*	0	6
3. Rush group	8	37
4. Black Sea 1	0	25
5. Gasaway group	4	0
6. Black Sea 2	0	5
7. Faroka group	6	11
8. Mixed/wild group	2	17
9. Spanish-Italian group	7	2
10. Moscow group	1	35
11. Polish-German group	0	8

Hazelnuts: A Promising Future

- Hazelnuts could be a major win for the producer, the environment, the rural economy, and the consumer
- Newly developed EFB resistant European hazelnut cultivars may allow production in Mid Atlantic and Fruit Belt regions
- Other hybrid hazelnut selections may have much broader climatic adaptation to large areas of the Central & Eastern US
- Multiple product opportunities:
  - Human food
  - Animal food
  - Cooking oils and biofuels
  - Flavorings, confections
  - Horticultural cultivars

Acknowledgements and thanks!

USDA

USDA Specialty Crops Research Initiative
Grant 2009-51181-06028

Specific Cooperative Agreement with
USDA for Eastern Filbert Blight Research

Oregon Hazelnuts — Indulgence in a Nutshell

Oregon Hazelnut Commission

OSU Oregon State University

Rutgers New Jersey Agricultural Experiment Station

University of Nebraska Lincoln

Nebraska Forest Service

Center for Turfgrass Science Rutgers

Nebraska Specialty Crop Program

USDA National Agroforestry Center

Arbor Day Foundation