



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

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# Hazelnut Facts

- Called hazelnut or filbert
- Hazelnuts - 5<sup>th</sup> 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)

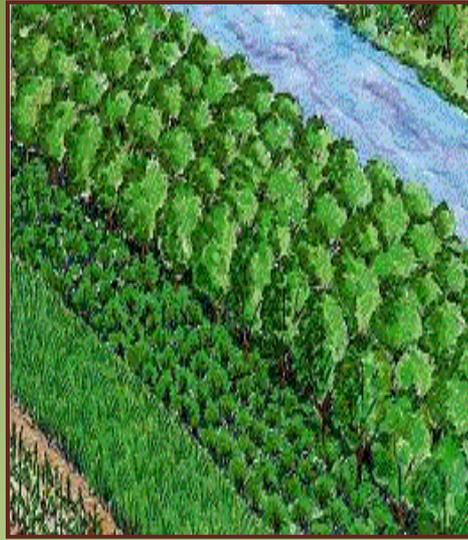


# “Productive Conservation”

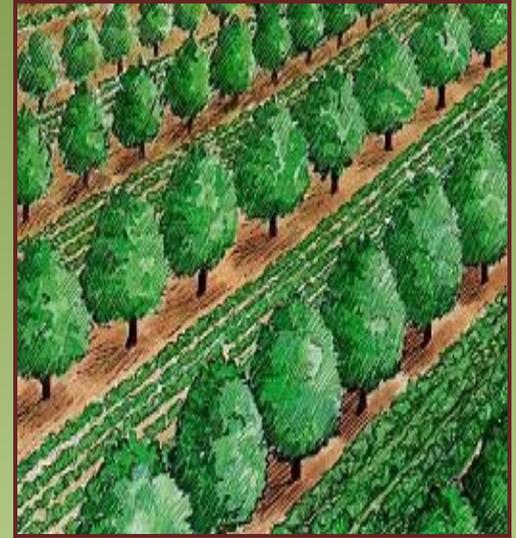
*Hazelnuts can be grown in orchards, or integrated into agroforestry systems, combining Production with Protection*



**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





# Addressing the Challenge: Hybrid Hazelnut R&D Consortium



- Dr. Shawn A. Mehlenbacher: Lead Hazelnut Researcher/Plant Breeder**
- *DNA Markers, Plant Breeding, World's Largest Germplasm*



- Dr. Scott J. Josiah: NE State Forester and Director, NE Forest Service**
- *Replicated Field Trials, Outreach and Education*



- 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 21<sup>st</sup> 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

	Known EFB-resistant	New EFB-resistant
1. out-group	3	1
2. Asian <i>C. heterophylla</i>	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!



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Oregon  
Hazelnut  
Commission



RUTGERS

New Jersey Agricultural  
Experiment Station



Nebraska  
Forest  
Service

Nebraska  
Specialty Crop  
Program



Arbor Day Foundation™