

A COLLECTIVE EFFORT: DEVELOPMENT OF A HYBRID HAZELNUT CONSORTIUM

Troy Pabst
Forestry Properties Manager
Nebraska Forest Service/ University of Nebraska



Hazelnut Consortium Partners

The logo for Oregon State University, featuring the text "Oregon State" in a large, white, serif font and "UNIVERSITY" in a smaller, white, sans-serif font, both set against a solid orange rectangular background.

Oregon State
UNIVERSITY

Oregon State

- Shawn Mehlenbacher, Vidyasagar Sathuvalli, Dave
- Hazelnut breeding and genetics, *Corylus* molecular biology

The logo for Rutgers University, featuring the word "RUTGERS" in a large, red, serif font, with "THE STATE UNIVERSITY OF NEW JERSEY" in a smaller, blue, sans-serif font below it, all on a white background.

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

Rutgers University

- Tom Molnar, Brad Hillman, Guohong Cai, John Capik
- Hazelnut breeding and genetics, EFB molecular biology

Hazelnut Consortium Partners



University of Nebraska/Nebraska Forest Service

- Scott Josiah, Troy Pabst, Milford Hanna, Loren Isom
- Field trials, outreach, oil research, new product development



National Arbor Day Foundation

- Doug Farrar, Adam Howard
- Outreach/ disseminate information, organization

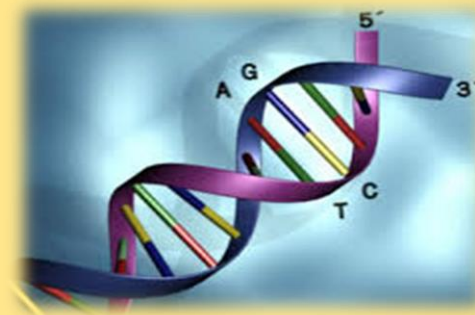
Main Focus of the Consortium

- To address the limiting factors of widespread hazelnut production within North America:
 - Lack of resistance to Eastern Filbert Blight (EFB)
 - a fungal disease caused by *Anisogramma anomala*
 - Ability to thrive in harsh weather conditions



Short-Term Goals

- Develop genomic tools for hazelnuts & the EFB pathogen
 - Study genetic variation in both organisms
 - Supplement traditional breeding approaches
 - Improve knowledge of host-pathogen interaction
- Establish plantings of native *C. americana* & cold hardy *C. avellana*



Short-Term goals cont.

- Develop improved EFB resistant hazelnut selections (*C. avellana* & hybrids)
- Focus on alternative hazelnut products
- Establish clonal replicated trials of new hazelnut selections
 - University of Nebraska-Lincoln & Rutgers
 - Other University collaborators
 - Potential growers



Hazelnuts within North America

- Two hazelnut species native to North America
 - American hazelnut & beaked hazelnut
 - Both resistant to EFB (is endemic to U.S)
 - Very small, thick shelled nuts
 - Difficult to remove from involucre (husk)
 - Plants sucker forming large clumps



arborday.org



enature.com

Hazelnuts within North America

- **EFB** = the primary reason that commercial hazelnut production has not evolved in the U.S. outside of Pacific Northwest (OR & WA)
- Hazelnut production had been established for nearly 100 years before EFB was found in the Northwest



Hazelnuts within North America

- American hazelnuts (*C. americana*) have been utilized in crosses with European hazelnut (*C. avellana*)



growingmagazin.com



Cfgrower.com

Hazelnuts within North America

- Focus on transferring multiple traits within these crosses
 - Cold hardiness
 - Disease resistance
 - Large nut size with thin shells
 - Nuts that not only fall free of the plant, they also fall free from the husk (involucre)



adagio.com

Specific Projects of the Consortium

- SSR (microsatellite) marker assessment of diversity in *C. avellana*, *C. americana* & hybrids
- Map-based cloning 'Gassaway' gene is complete
 - Self-incompatibility issue = next target
- Sequence the European hazelnut genome
 - Develop genetic tools for breeding



Specific project of the Consortium

- Sequence EFB pathogen genome:
 - Develop markers to study population biology & diversity
- Develop real-time PCR detection assay for EFB pathogen (rapid screening test)
- Collect & evaluate the diversity of *C. americana*
- Assess kernel oil content, kernel composition & other attributes



Status of hazelnuts within each of the partners- Oregon State University (OSU)

- **Oregon State University (OSU)**
 - Largest research & breeding program in the **WORLD**
 - Started in 1969
 - Currently led by Dr. Shawn Mehlenbacher
 - Previously Maxine Thompson & Harry Lagerstedt
 - Focus on kernel market started in 1979



Status of hazelnuts within each of the partners- OSU

- Only public hazelnut breeding program in the U.S. for many decades
- OSU & the U.S. Dept. of Ag, ARS, National Clonal Germplasm Repository
 - Assembled a collection of > 850 hazelnut accessions
 - Including all major as well as many minor hazelnut species



botanicajardines.com



Stories.rbge.org.uk

Status of hazelnuts within each of the partners - OSU

- Breeding EFB resistance at OSU
 - ‘Gasaway’ (old pollinizer with small nuts)
 - = **First** cultivar identified with resistance to EFB
 - Found to transmit a dominant gene carrying resistance
 - Widely used in OSU breeding program



arborday.org

Status of hazelnuts within each of the partners - OSU

- EFB resistant cultivars carrying the 'Gasaway' gene were released in 2005
 - 'Jefferson', 'Yamhill' and 'Santiam'
 - 'McDonald', 'Dorris' and 'Wepster' later releases

● photozok.com



■ naturetechnursery.com



Status of hazelnuts within each of the partners - OSU

- New EFB resistant cultivars revitalize hazelnut production in the Northwest
 - Adding ~ 3,000 acres per year
 - Currently 30,000 acres of hazelnuts in Oregon
 - Produce 99% of U.S. crop



Willamettehazelnuts.com

Status of hazelnuts within each of the partners – Rutgers University

- Nut tree project started by successful turf grass breeder Dr. C Reed Funk
- Ongoing nut tree research since 1996
Original title of the project: “Under Utilized Perennial Food Crops Genetic Improvement Program”
- Current project leader: Dr. Thomas Molnar



Status of hazelnuts within each of the partners – Rutgers University

- Main focus on hazelnuts
 - Studying the EFB –Pathogen
 - Identifying sources of EFB resistance
 - Developing EFB resistant plants for the Northeast



Status of hazelnuts within each of the partners – Rutgers University

- Major question:

Will sources of EFB resistance from Oregon hold up in the eastern U.S.?



farmenertmedia.extension.org



Status of hazelnuts within each of the partners – Rutgers University

- Why not?
 - Different climatic patterns
 - Higher disease pressure
 - Greater diversity of EFB isolates
 - EFB in Oregon is believed to stem from a SINGLE point infection



farmenerymedia.extension.org

Status of hazelnuts within each of the partners – Rutgers University

- Collection of EFB isolates from multiple states
 - As many as 6 genetic differences identified throughout the U.S.



arborday.org

Status of hazelnuts within each of the partners – Rutgers University

- Increased EFB pressure at Rutgers research plots
- OSU screens some of its material at the Rutgers location
- Currently on the 2nd phase of screening several potential releases from their breeding program



arborday.org

Status of hazelnuts within each of the partners – University of Nebraska/ Nebraska Forest Service

- Breeder seed from OSU and Rutgers
- Have surpassed the 5,000 seedling mark averaging 1,200 seedlings/yr.
 - Seed from *C. avellana* x *C. americana* & some *C. avellana* x *C. avellana*



Status of hazelnuts within each of the partners – University of Nebraska/ Nebraska Forest Service

- Some testing of clones from OSU & Rutgers
- “Northern” cultivar evaluation
 - 8 northern cultivars not derived from the OSU program
 - Gellatly 502, 188P, G17, Box 1, 88BS, FE2A, Skinner, Grand Traverse



photozok.com



Status of hazelnuts within each of the partners – University of Nebraska/ Nebraska Forest Service

- **HARSHEST** climate for cold hardy testing of hazelnut selections
- Winter of 2013 put many plants to the test
 - Some trial plants had heavy dieback & many catkins killed
 - Little nut production in 2014



Status of hazelnuts within each of the partners – University of Nebraska/ Nebraska Forest Service

- Screening of Arbor Day Farm hazelnut planting
 - ~ 5,000 hybrid hazelnut plants
 - Identified 10 plants
 - 5 showing little to no issues with EFB after 9 years of field trials at Rutgers University



Status of hazelnuts within each of the partners – University of Nebraska/ Nebraska Forest Service

- Submitted 3 potential cultivars to tissue culture lab for reproduction
 - ‘Grand Traverse’- from CV trial
 - 10-50
 - “The Beast”



Status of hazelnuts within each of the partners – University of Nebraska/ Nebraska Forest Service

- UNL's Industrial Agriculture Products Lab's focus:
 - Oil for food applications
 - Oil for biodiesel
 - Meal for food and feed applications



sunset.com

Status of hazelnuts within each of the partners – Arbor Day Foundation

- Started in 1996
- Planting of > 5,000 hybrid hazelnut seedlings at Arbor Day Farms in Nebraska City, Nebraska
 - Badgersett seedlings
 - ADF's seedlings:
 - Open pollinated seedlings from Badgersett seedling planting



Status of hazelnuts within each of the partners – Arbor Day Foundation

- Started hazelnut outreach project in 2000
- By 2010 program achieved 100,000 active members



Status of hazelnuts within each of the partners – Arbor Day Foundation

- ADF's role within the Consortium:
 - Outreach
 - Coordinating Consortium activities
 - Establishing & maintaining website devoted to Consortium activities





OK. What's next ??

Growing hazelnuts in the Plains

- Some unknown pieces of the puzzle
 - What form will the plant be grown as?
 - Will the end product fall free from the plant as well as the involucre?
 - What type of harvest technique will be used?



Growing hazelnuts in the Plains

- Will the nuts need to be cleaned to remove the involucre or will they fall free?
- What market will we strive for – Kernel, Oil, In-shell?
 - How will we get the product to **THAT** particular market?



adagio.com



sunset.com

Growing hazelnuts in the Plains

- Possible product outlets:
 - “Heartland Nuts n More”, Valparaiso, NE
 - Confections
 - Gourmet restaurants
 - Internet



[facebook.com](https://www.facebook.com/heartlandnutsnmore)



topsellingcandy.com



melecotte.com

Growing hazelnuts in the Plains

- **REMEMBER:**
 - Many of the hazelnut cultivars that are derived from the OSU breeding program are listed as RESISTANT to EFB
 - This means they are resistant to the **ONE STRAIN** of EFB found in the Northwest and may *NOT* be resistant to the strain found in YOUR region



arborday.org

Growing hazelnuts in the Plains

- When will hazelnut cultivars become available from this project?
- Even with the established hazelnut breeding program that OSU has, it takes approximately **15 yrs.** from seed to a named cultivar release



willamettehazelnuts.com

Growing hazelnuts in the Plains

- Who else is working on hazelnut production?
- Upper Midwest Hazelnut Development Initiative
 - www.midwesthazelnuts.org



extension.org

QUESTIONS???????



amusingtime.com