Chestnuts: Building a Perennial Specialty Crop Industry From Scratch

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AGROFORESTRY DEFINED

Mixtures of trees, crops and/or livestock to promote both resource protection as well as economic production.

Five recognized agroforestry practices

Alley Cropping – Trees in rows with intercrops

Silvopasture – Trees, forage and livestock

Riparian and Upland Forest Buffers – protect streams

Windbreaks – Widely spaced rows to protect crops

Forest Farming – Cultivating beneath forest canopy
Specialty Nut Crops: Issues of Concern

- Farmers planting emerging specialty nut crops (chestnut, black walnut, elderberry, pawpaw, etc.) in the Midwest in response to increasing market opportunity.

- Farmers taking substantial risks due to the lack of sound horticultural and market information.

- Farmers who purchase emerging specialty nut crop nursery stock may be planting inferior material.

- Detailed financial decision making information is lacking for most specialty crops.

- Lack supporting infrastructure.
Alley Cropping

Planting trees or shrubs in rows at wider spacings, creating alleyways within which agricultural, horticultural, or forage crops are cultivated.

- Diversify farm enterprise
- Reduce erosion
- Improve water quality
- Protect crops
- Enhance biodiversity, wildlife habitat
- Improve aesthetics
Nut Trees for Alley Cropping

Black walnut

Northern pecan

Chinese chestnut
Eastern Black Walnut

6 row corn planter, trees on 22.5 foot centers, 5 feet between trees in the row

Age 3

Age 5

Age 9, 35 ft. tall and time to thin
Double row planting plan for pecan orchards. Tree locations marked by circles.

Double row pecan. 2 years after tree establishment. **Soybean intercrop.**

Double row pecan. 4 years after tree establishment. **Spring oat intercrop.**
Chinese Chestnut – Pumpkin Alley Cropping
Napton, MO
Chinese Chestnut – Winter Wheat
Alley Cropping
Napton, MO
The MU Center for Agroforestry’s Chestnut Program

1. Develop and test best chestnut cultivars and orchard production, management and harvest techniques
2. Ongoing market and consumer research
3. Increase consumer awareness and demand
4. ***Support growth of future chestnut farmers
5. Future: Value-added product development not yet in our research portfolio. Needs to be.

Goal: Develop a thriving Missouri chestnut industry
Chestnuts in the “Beech” Family

- Beech - beechnuts
  - *Fagus*

- Oaks - acorns
  - *Quercus*

- Chestnuts - chestnuts
  - *Castanea*

- Horse Chestnut - not related to true chestnuts
  - *Aesculus* (aka buckeye)
  - Not edible
Chestnut Topics to Review

- Why a Missouri Chestnut Industry?
- What we know about chestnut production
- Markets and consumers
- What’s on tap for 2014?
Why a Missouri Chestnut Industry?

• Missouri has ~107,000 farms, 2nd in USA
• Average farm size ~270 acres
• Commodity grain, seed crops dominate
• Large scale animal agriculture operations
• As is the case almost everywhere, making a living from traditional commodity production is tough for the family farm.
• Economically viable farms are very large scale
Why a Missouri Chestnut Industry?

- Missouri has a small tree fruit industry and our growers face fierce competition and low prices.
- New profitable farm-based enterprises are needed to provide alternatives for the family farm.
- Enterprise profitability will allow future generations to remain on the farm; strengthen rural communities.
Why a Missouri Chestnut Industry?

- Research on the U.S. chestnut industry reveals that:
  - Demand outstrips supply for full-time U.S. chestnut producers
  - Growers of high quality chestnuts - with market knowledge - receive high prices.
Chestnuts for Missouri?

- A perennial crop, Chinese chestnut orchards well suited to sloping, fertile, deep, erodible loess soils in Missouri River Hills region.
- The River Hills region has 3 million acres of land.
Chestnut: Building a New Specialty Crop Industry in Missouri

Can we grow them?  Yes

Are the yields good?  Yes

Are there markets?  Yes

Are the prices good?  Yes

Well then, what’s the hold up?
The status of our knowledge

This is a NEW crop for the Midwest

➢ There is a lot we do not know

➢ There is a lot we do know

➢ What we don’t know (but we are getting there)
   • Which cultivars are best for which locations?
   • Current situation
     ➢ Small acreage under test at HARC (<8 acres total)
     ➢ Plantings are young
     ➢ HARC cultivars still increasing in annual yield
The status of our knowledge

What we do know

- Chinese chestnuts grow well in Mid-Missouri
- Matching to proper sites is critical (wet feet deadly)
- Grafting success high (except ‘Qing’ and ‘Eaton’)
- Annual yields, selected trees, impressive (+100 lbs/tree)
- HARC has only ~6 acres of young, commercially producing chestnuts (65 different cultivars)
  - Yield in 2007 = 4,000 lbs (spring freeze, dry year)
  - Yield in 2008 = 6,000 lbs (excellent moisture)
  - Yield in 2009 = 10,000 lbs (excellent moisture)
  - Yield in 2013 = 14,000+ lbs (late summer drought)
- Irrigation (moisture) appears key to annual crop success
What we do know

- Wide selection of cultivars **not** widely available commercially (see Forrest Keeling Nursery)
  - Currently recommend only 4 cultivars **out of 65** under test

- Commercial production should be based on growing **tested chestnut cultivars**
  - Repeated harvests (daily) required to ensure crop quality
  - Post harvest storage quality differences between cultivars
What we do know

• Successful growers exist, cannot meet demand

• Consumers receptive when exposed to chestnuts
  ➢ Preferences for “Buy Local” premium is for real!

• Direct-to-market retail / wholesale prices are high
  ➢ Wholesale $2.00-$3.50/lb
  ➢ Retail 4.50-$8.00/lb

➢ Producing and marketing a quality product is essential for market growth
Chestnut Production
• What spacing and pruning method is best for Missouri growers?
• Standard central leader pruning 30’ x 30’ (48 trees/acre)

Herbicide strip
Drip irrigation
Chestnut Production Guide to Support Growers

• ‘Qing’
• ‘Sleeping Giant’
• ‘Gideon’
• ‘Peach’ (for hobbyist)

Chinese chestnut is an emerging new tree crop in Missouri and the Midwest. The Chinese chestnut tree is a spreading, medium-sized tree with glossy dark leaves bearing large clusters of nutritious nuts. Nuts are borne inside spiny husks that split open when nuts are ripe. Each husk contains one to three shelly, dark brown nuts. Nuts are microwaved or boiled to help remove the leathery shell and papery seed coat, revealing a creamy or golden-colored mast. Chestnuts are a healthy, low-fat food ingredient that can be incorporated into a wide range of dishes—from soups to poultry stuffing, to pancakes, muffins and pastries (using chestnut flour). Historically, demand for chestnuts in the United States has been highest in ethnic markets (Italian and Asian) but as Americans search for novel and healthy food products, chestnuts are becoming more widely accepted. The University of Missouri Center for Agroforestry conducts one of the nation’s most comprehensive programs for developing the Chinese chestnut into a profitable orchard crop. There are three field studies, a repository with 55 cultivars, a cultivar trial, and a root production orchard at the Center’s research farm in New Franklin, Mo. Market evaluation and consumer research toward chestnuts is also conducted by the Center.

Chestnut Species

Three species of chestnut provide the basis for world wide chestnut production—Chinese chestnut (Castanea mollissima), European chestnut (C. sativa) and Japanese chestnut (C. crenata). Chinese chestnuts are a medium-sized (40 ft.) tree often multi-branched and widely spreading. With both good cold hardiness (30°F) and adequate tolerance to chestnut blight, Chinese chestnut is the best adapted chestnut for Missouri and surrounding states. The European chestnut is a larger tree (60 ft.), wide spreading and generally less susceptible to chestnut blight than the American chestnut. The Japanese chestnut is a small to medium-sized tree (30 ft.) but lacks the blight tolerance and winter hardiness of the Chinese chestnut. European and Japanese chestnuts are grown commercially in west coast states where chestnut blight is not as pervasive and the climate milder. Chestnut species hybridize readily, resulting in many selected hybrid cultivars. Several Japanese x European hybrid cultivars are under test at the University of Missouri Horticulture and Agroforestry Research Center in New Franklin, Mo. But long-term observation will be needed to determine if any have enough blight tolerance and climatic hardiness to be recommended for planting in Missouri.

Three Castanea species are native to the U.S. American chestnut (C. dentata), Allegheny chestnut (C. pumila var. pumila), and Ozark chestnut (C. pumila var. crenata), but all three are very susceptible to chestnut blight attack. In fact, the devastation caused by chestnut blight (Cryphonectria parasitica) stem canker has reduced American chestnut from a major timber species to a small ornamental tree. The Allegheny and Ozark chestnuts are multi-stem shrubs to small trees that produce small, tasty nuts and make interesting but blight susceptible landscape trees that are also useful for wildlife.
# Top Ranked Chestnut Cultivars 2006 - 2010

## Nut weight (g), tree yield (lbs), selected cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Year Grafted</th>
<th>Mean nut wt. (g) 06 / 07 / 08 / 09 / 10</th>
<th>Mean yield/tree (lbs) 2006 / 2007 / 2008 / 2009 / 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mossbarger</td>
<td>1996</td>
<td>18.8 / 17.0 / 15.3 / 12.1 / 15.2</td>
<td>22.7 / 15.2 / 39.5 / 92.6 / 46.4</td>
</tr>
<tr>
<td>Kohr</td>
<td>1996</td>
<td>15.7 / 15.8 / 15.0 / 15.3 / 14.2</td>
<td>18.3 / 21.2 / 19.0 / 44.3 / 48.6</td>
</tr>
<tr>
<td>Sleeping Giant</td>
<td>1996</td>
<td>15.0 / 16.4 / 15.5 / 14.6 / 13.6</td>
<td>15.0 / 18.7 / 33.5 / 58.0 / 48.1</td>
</tr>
<tr>
<td>Auburn Homestead</td>
<td>1996</td>
<td>14.0 / 17.6 / 11.8 / 10.3 / 15.9</td>
<td>40.1 / 13.7 / 44.1 / 84.0 / 50.8</td>
</tr>
<tr>
<td>Eaton</td>
<td>1998</td>
<td>17.0 / 15.4 / 13.4 / 13.1 / 12.0</td>
<td>11.7 / 7.1 / 18.3 / 36.6 / 34.6</td>
</tr>
<tr>
<td>Qing</td>
<td>1999</td>
<td>19.5 / 12.5 / 12.0 / 11.6 / 17.8</td>
<td>32.0 / 82.7 / 82.7 / 100.3 / 88.0</td>
</tr>
<tr>
<td>Gideon</td>
<td>1999</td>
<td>17.5 / 11.0 / 11.9 / 12.4 / 14.4</td>
<td>12.3 / 28.7 / 37.7 / 52.2 / 40.7</td>
</tr>
<tr>
<td>Perry</td>
<td>1999</td>
<td>13.2 / 10.5 / 9.9 / 12.8 / 10.8</td>
<td>37.3 / 39.7 / 50.0 / 56.7 / 76.9</td>
</tr>
</tbody>
</table>

To achieve 2,000 lbs per acre, annual yields must average ~40 lbs (18.1 kg) per tree.
Insects

- Scout for foliage eating insects (potato leaf hopper, yellow necked caterpillar, Japanese beetles).

- **Potato leaf hopper** creates cupped, deformed leaves, find leaf hopper feeding on underside of leaf (early June)

- Sevin can be used as control. BT against caterpillars.

- **Chestnut weevil**. Controlled chemically with Sevin or organically (hot water bath).

- Chestnut gall wasp (big problem, not yet in Missouri).
Chestnut Weevil

- Once weevil finds orchard – build up quickly
- SANITATION: Pick up all nuts promptly to break insect cycle to delay/minimize insect buildup
- Next step: either spray Sevin in August and September -- OR -- use organic method hot water bath treatment
Disease

• Phytophthora root rot - when roots are waterlogged.
• Chinese chestnut is somewhat tolerant of root rot. Plant on well-drained sites.
Growing Chestnuts - Fertilize

- Split application of fertilizer.
- Fertilize at bud swell (~April 1\textsuperscript{st}) and at end of flowering (~June 20\textsuperscript{th}).
  - Fertilize 50% each time.
  - Ammonium nitrate or urea \( @ 100 \text{ lbs actual N /acre} \)
  - Apply 0.1 lb actual N per tree per year of age.
  - Example, 3 year-old tree gets 0.3 lbs actual N per tree
Weed Control

- Spring, use Roundup once weeds begin to compete with tree growth for moisture.
- During growing season maintain a relatively weed free zone, use Roundup as needed.
- Late August, no further weed control is used to permit winter annuals (henbit, downy brome “cheat”) to cover the soil for winter protection.
Harvest

- Harvest season early September to early October
- Different cultivars mature at different times.
  - Pick up nuts at least every other day to preserve nut quality (daily is better).
  - Size, wash / float, sanitize
- Promptly store nuts in a refrigerator (32° F or slightly above) in sealed plastic bags (one to two gallon bags work well) or mesh bags.
Harvest

• Hand harvest until crop size justifies need to purchase mechanical harvester.

• Seasonal labor is an issue!!! Mechanized harvester will be required.

• Pay “by the bucket” for hand harvest (~0.50 cents per pound).

• Use “nut wizard” about $45 each.

• Pecan cleaner to separate nuts from trash. Air separation (blower).

• Run through “size sorter”
Commercial Harvest Options
Coming to Missouri in 2014!

FACMA Harvesters from Italy
Cost ~$30,000 - $150,000
Post Harvest

- Wash with Stor-Ox (H₂O₂) or dilute bleach wash (1%) to sanitize nuts.

- NOTE: bleach must be thoroughly rinsed off chestnuts prior to refrigeration and sale.

- When washing chestnuts, remove floaters.

- Store in refrigerated cooler ~32°F.

- Store in refrigerator in plastic or mesh bags.

- Chestnuts are the UnNut. 50% moisture. They will mold if left unrefrigerated for a week.
Chestnut Prices

- Full-time farming operations received better prices.
- Producers obtained higher prices if they:
  - grow chestnuts from cultivars
  - grow organic (pesticide free) chestnuts
  - grow large sized chestnuts (over 1 1/8\text{th} inch)
  - sell under a brand name
  - sell locally/regionally ("buy local" price premium)
  - sell direct to retail (but a ton of work)
Regional Chestnut Prices

- Clovers in Columbia, Missouri retailing locally grown chestnuts for $5.25 per pound (wholesale price $3.50 per pound)
- Chestnut Charlie sold direct to consumer at Missouri Chestnut Roast for $4.50 to $6.50 per pound depending on size
- Center for Agroforestry sells at Columbia Farmers Market for $5.00 per pound.
At present, most sales are fresh chestnuts.
Consumer Surveys 2003 - 2009

Results

- Most participants did not know that chestnuts need to be refrigerated, are very low in fat and gluten free.

- The public and retail produce managers know little about chestnuts (must be kept refrigerated until eaten)

- Need to be educated about how to buy, store and prepare chestnuts

- Need information on nutrition and health benefits

- “Locally grown” very important to consumers (more important than organic)
Educate The Consumer

- Missouri Chestnut Roast – 2003-2010 to introduce chestnuts to the public
- Show consumers how to select, store and cook them
- Chef demonstrations
- In store recipes
Market Outlets

- Festivals
  - Great River Road Chestnut Roast – Forrest Keeling Nursery

- Farmers Markets

- Retail sales: HyVee, Whole Foods, Hen House, Schnucks)
What do you do with chestnuts?

- Roast them fresh
- Dry and grind into chestnut flour: biscuits, lasagna
- Coat with chocolate or honey – marrone glace
- Make into a sweet puree
- Make into soups, dumplings, breads
- Cook with: turkey, ham, rabbit, roast beef, wild boar
- Ferment into beer, liquors
Future Market Growth

• Create value added products
  ➢ Chestnut flour (gluten free) and associated product mixes
  ➢ Baked goods
  ➢ Chestnut puree
  ➢ Chestnut honey
  ➢ Peeled frozen
  ➢ Chestnut beer, liquor
  ➢ Chestnut (acorn) reared pork products
New - Coming in 2014
Growing Missouri’s Chestnut Industry - Harvesting, Marketing and Financial Decision-Making

(1) Mechanized harvest demonstration workshops;
(2) “Time-and-motion” study to quantify the labor saving benefits of a commercial harvester;
(3) Create, demonstrate and release a Chestnut Financial Decision Support Tool to help chestnut growers and other decision makers (e.g., cooperatives, agricultural lenders) make financially sound management and investment decisions; and
(4) Provide advanced financial and market information to enable growers to profitably sell their chestnut crop
5. Create Chestnut Financial Decision Support Tool

Coming within the year...

**Chestnut Financial Decision Support Tool - CFDST**

**Version 1.0**

<table>
<thead>
<tr>
<th>Establishment Decisions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Prep:</td>
</tr>
<tr>
<td>Herbicide only (1 qt/ac.)</td>
</tr>
<tr>
<td>Spacing (ft):</td>
</tr>
<tr>
<td>30 x 30</td>
</tr>
<tr>
<td>Layout/Design:</td>
</tr>
<tr>
<td>Rectangular/Square</td>
</tr>
<tr>
<td>Site Quality:</td>
</tr>
<tr>
<td>Good</td>
</tr>
<tr>
<td>Planting Stock:</td>
</tr>
<tr>
<td>Seedlings [bare root]</td>
</tr>
<tr>
<td>Technique:</td>
</tr>
<tr>
<td>Self Grafted (Hybrid)</td>
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<tr>
<td>Fertilization:</td>
</tr>
<tr>
<td>Good early growth (&gt; 8&quot;)</td>
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<tr>
<td>Tree Staking:</td>
</tr>
<tr>
<td>T-posts</td>
</tr>
<tr>
<td>Irrigation system:</td>
</tr>
<tr>
<td>Drip Irrigation</td>
</tr>
</tbody>
</table>

**Harvesting and Marketing Decisions:**

- **Harvest Method:** Mechanized (unspecified)
- **Expected Rate of Return:** 5%
- **Expected Price/lb for nuts:** $3.50
- **Total number of Acres in Chestnut:** 10

For more information about Establishment, Management, Harvesting and Marketing of Chinese Chestnuts click on the following link:

UMCA Chestnut Guide

**Financial Results**

Based on the information that was entered in the model, this Chinese Chestnut Orchard will have the following financial performance over a 70 year period:

<table>
<thead>
<tr>
<th>Initial Number of Trees/ac</th>
<th>484 on 10 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Price/1b for nuts</td>
<td>484 on 10 acres</td>
</tr>
<tr>
<td>PV of Revenues/ac @ 5%</td>
<td>$327707.04</td>
</tr>
<tr>
<td>PV of Costs/ac @ 5%</td>
<td>$155389.92</td>
</tr>
<tr>
<td>NPV/ac @ 5%</td>
<td>$171681.25</td>
</tr>
<tr>
<td>Rate of Return (MIRR)</td>
<td>5%</td>
</tr>
<tr>
<td>Years to Break Even</td>
<td>5</td>
</tr>
<tr>
<td>AEV/ac @ 5%</td>
<td>$906.96</td>
</tr>
</tbody>
</table>
Join the Chestnut Growers of America

Chestnut Growers of America
(formerly known as Western Chestnut Growers' Assn.)
Your Resource for Chestnuts and the Chestnut Industry

NEWS AND EVENTS

CGA Annual Meeting and North American Chestnut Farm Workshop
Aug. 30 - Sept. 2, 2012
Jackson, MI

Fifth International Chestnut Symposium
Sept. 4-8, 2012
Shepherdstown, WV

National Chestnut Week
Sunday, Oct. 14 - Saturday Oct. 20
2012

Look for chestnut festivals and other special events in your area.

American Grown Chestnuts
...ask for them in your store

You'll find them at the orchard or in your local supermarket from September through December. Ask your produce manager to make sure they were grown in the U.S.

You can also buy direct from many growers. Go to "GROWERS" and select "DIRECTORY" to find a grower in your area of the country.

Chestnut Growers of America
represents chestnut growers, researchers and others throughout the United States and Canada. They bring high quality chestnuts to the marketplace and to your family's table.

www.chestnutgrowers.com
Questions?