

The Chestnut Grower's Primer

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Chestnut Growers' Primer

Southeast Iowa Nut Growers

Introduction

This primer is designed to give the prospective chestnut grower basic background information about what is involved in successful chestnut production in Iowa. It will outline the minimum requirements of soil, climate, equipment, labor, and capital. Rural landowners should be able to use this information to help decide whether chestnut growing is feasible and desirable for them. This primer is not intended as a complete manual for chestnut production. Members of the Southeast Iowa Nut Growers Cooperative are available for helping prospective and novice growers with specific questions or problems. This primer was made possible by a grant from the Iowa Department of Agriculture and Land Stewardship, and with assistance from the Practical Farmers of Iowa.

Background Information

Chestnuts are trees or shrubs in the genus *Castanea*, and are in the same family as oaks and beeches. They are not related to horse chestnuts, (whose nuts are poisonous) or to water chestnuts. There are four species of commercial importance. The American chestnut of the eastern United States was once the most important species of tree in North America (Figure 1). They are the hardiest of all chestnuts. They can withstand temperatures as low as -50°F (zone 3). The American chestnuts were practically eliminated by the fungal disease called chestnut blight, between about 1910 and 1950. The nuts of American chestnuts are high quality and very sweet, but they are too small to be considered commercially important. The trees are so susceptible to the chestnut blight disease they are not feasible to grow commercially.

The European and Japanese chestnuts are the most common chestnuts in international commerce. Their nut size is very large, but their quality and flavor are the poorest of all chestnut species. The European



Figure 1. Loggers, standing at the bases of giant American chestnuts in the Appalachians. Photo courtesy of Forest History

chestnut trees usually have little or no resistance to the chestnut blight. Japanese chestnuts usually have some degree of blight resistance. Both of these species are marginally hardy in zone 5.

The Chinese chestnut is the most variable of all the species. The growth form may range from a low, spreading shrub to a tall timber tree. The nut size ranges from as tiny as the Americans to larger than the largest Japanese and Europeans. The nut flavor ranges from as good as the Americans to as poor as the Japanese and European chestnuts, and is not necessarily related to the nut size. The other measures of nut quality such as appearance, peelability, kernel texture, and storage quality, are almost always superior in the Chinese chestnut when compared to the Japanese and Europeans. This species is variable in hardiness. Chinese chestnut from southern sources might not survive even one mild winter in southern Iowa. The hardiest can survive -40°F with no damage. A strain of Chinese x American hybrids from Canton, Minnesota is hardy to -50°F.

The Chinese chestnut is the only species with enough resistance to chestnut blight to be commercially viable in the Midwest. Many are completely immune, and most are at least very resistant to the blight. Only a small percentage are susceptible. For the rest of this discussion, when we refer to chestnuts we are talking about Chinese chestnuts or hybrids with Chinese.

Chestnuts in World Commerce

The history of chestnuts as a commercial crop goes back at least 5,000 years (corn only goes back 1,000 years). In all that history the supply has never been able to meet the demand. Chestnuts rank 3rd (among nuts) in the world, behind only coconuts and peanuts. Demand for chestnuts exceeds the demand for almonds and all types of walnuts, combined. Chestnuts are the 3rd most important food crop in China, behind only rice and wheat, and ahead of corn. All this suggests chestnuts are neither a fad nor a niche crop.

The U.S. imports over 40 million pounds of chestnuts per year. Less than a million pounds are produced domestically. Most of the imports are livestock-feed grade nuts from Italy. Besides being poor quality to begin with, most of these nuts are moldy or even rotten by the time they arrive. Korea will probably begin importing large amounts of large but equally poor quality nuts within the next few years.

It is reasonable to conclude high quality, good tasting, and locally grown chestnuts could out-compete and displace some of the poor quality but expensive imports. Growers in Southeast Iowa have been receiving between \$2 and \$4 per pound over the last two years (2000 and 2001), and had no trouble selling all of the crop locally. A surge in interest in chestnuts has resulted in many new plantings in the last 20 years. Even so, at the rate new chestnut plantings are going in, it will take between 80 and 100 years before there are enough acres to meet the demand in the U.S. as it exists today, (and demand has about doubled in the last 10 years). In short:

- Demand for chestnuts is high, genuine, and long-term.
- There is no foreseeable danger of overproduction within at least the next 100 years.
- Prices paid for chestnuts have always been high, and are going higher.
- We can grow them in Iowa (and we are).

Chestnuts as a Cash Crop

Chestnuts have a lot of advantages as a cash crop for Iowa. Unlike most other nut crops, chestnuts tend to be heavy annual bearers (many other nut trees bear a good crop every other year, or even less). Worldwide, chestnut production tends to range between 1000 to 9000 lbs per acre. We are conservatively estimating production in Iowa to reach between 1000 and 2000 lbs per acre at maturity (it will probably end up higher). Net profits should range from \$1000 to \$6000 per acre annually. Chestnuts can be grown on land which would be marginal for other crops. A few other advantages:

- Chestnuts could easily be grown without chemical fertilizers or pesticides.
- They can be grown and harvested without expensive or specialized equipment.
- Chestnuts are long lived (1000+ years) so they only need to be planted once.
- Soil erosion from a well-managed chestnut planting should be at least 1000 times lower than from no-tilled row crops.
- Chestnuts can be profitable even on a small scale. A farm family could earn a very good living on as few as 10-40 acres.
- Chestnuts have great potential for strengthening or even rebuilding rural communities.

There are a few serious disadvantages to chestnuts as a cash crop:

- Chestnuts require a considerable investment in capital and labor up-front, just to get them established, then there is no significant return for at least 5-6 years (average about 7-8).
- Marketing requires some effort and ability (unless you market through a cooperative). You can't just take them down to the local elevator.
- The crop is perishable. It must be kept from drying out, and should be refrigerated until sold.
- There is a serious lack of experience and expertise on the subject of chestnut growing, both in Iowa and nationwide (the Southeast Iowa Nut Growers can provide some assistance here).

This primer is intended to help prospective chestnut growers weigh the advantages and disadvantages, and decide whether chestnuts will be a good choice for them.

Successful Chestnut Growing—What Does it Take?

Before going any further it should be stated that nothing in this primer should be interpreted as a recommendation to plant a large monoculture of chestnuts. Large monocultures of anything (including corn and soybeans) are invitations to pest and disease. They usually require a great investment in energy, labor, and chemicals to maintain, and will probably fail in the end anyway. There are a number of other high-value tree crops which could be interplanted with chestnuts to attain the high level of biodiversity needed to control pests and diseases naturally. Information about other crop trees and how they can be incorporated into a chestnut planting is available from the Southeast Iowa Nut Growers (see Appendix).

The first important step in establishing a chestnut planting (once you've decided to do it) is careful planning. This process should start at least 6 months to a year before any work is started. Unless you are already a tree farmer, or at least have a lot of experience and a track

record of success in tree planting (two or three trees in your yard doesn't count), you should get help with this step. Your local DNR district forester should be one of the most helpful persons with this step. Besides being able to help you put a tree planting plan down on paper, foresters have a lot of expertise in site selection, site preparation, tree planting, post-planting care and maintenance, ground cover, weed control, and protection from deer/rabbit/mouse damage. Your local NRCS office can be very helpful in evaluating a potential site for suitable soil types. They may also be able to provide some cost sharing for tree planting in some cases. For selection of species, strains, and varieties of chestnut seed, nursery stock, and related supplies, consult the information sources listed in the Appendix. Also listed in the Appendix is a list of organizations which could be very helpful, and their membership fees could be some of the best investments you ever make.

At a minimum, items to be addressed in your planting plan should include:

- Site selection
- Site preparation
- Between-row ground cover
- Between-row mowing (frequency and height)
- Spacing between and within rows
- Selection of seed or nursery stock
- Planting (trees and ground cover)
- Weed control
- Control of deer, rabbit, and mouse damage
- Prevention of damage from fire and herbicide drift
- Management of soil pH (in areas with high pH soils)

This plan should be down on paper, referred to frequently, and followed. It should be flexible, and should be amended as necessary. Unanticipated problems will crop up, and will need to be addressed, but not by ignoring or discarding the plan.

Site Selection

Site selection is the first, and possibly the most important step in the planning process. You need to decide if chestnuts can be grown in your area, and on your soil. In general, if you live south of a line from about Maquoketa, through Cedar Rapids and Ames, to Council Bluffs, then you are probably within the climate range where pure Chinese chestnuts can be grown (as long as they are from northern, hardy sources). The closer you get to that line, the more marginal they become. North of that line, but east of Interstate 35 (roughly the Northeast quarter of the state), the hybrid chestnuts developed at Badgersett Research Farm at Canton, Minnesota are a viable alternative to the pure Chinese chestnuts. Their nut size is a little smaller, but still large enough for commercial purposes. They have blight resistance, and are hardy to about -50 F. West of I 35, in the Northwest corner of the state, the Badgersett hybrids could still be grown, but with more difficulty. In that area they would need a windbreak to the north and west, and careful management of soil pH.

After climate, the next most important site consideration is soil drainage. Chestnuts require a well-drained soil. They will not tolerate poor drainage. They will tolerate dry, sandy or gravelly soils. If you are not intimately familiar with the soil drainage characteristics of a particular site, you should consult the NRCS or your district forester.

Soil pH is another important consideration for site selection. Chestnuts grow best in a pH range between 5.5 and 6.5. Most soils in Eastern Iowa are within that range naturally. The farther west you go, the higher the pH. West of Des Moines the soils are often 7.0 or higher. Calcareous soils in Northeast Iowa often have this problem too. Chestnuts can be grown in these areas, but the soil pH has to be amended first, and managed thereafter.

Avoid frost pockets and areas with danger from fire and herbicide drift from adjacent fields, if possible. In short, the three most important considerations for site selection are: climate, soil drainage, and soil pH. The only one you can change practically is pH.

Site Preparation

Before chestnuts or any other trees are planted, the planting site should be prepared to receive them. If undesirable vegetation exists on the site it should be controlled or eliminated. The worst plants to have on a tree-planting site are smooth brome, orchard grass, tall fescue, and alfalfa (and in that order). If any of these are present the entire area should be completely killed and reseeded to more compatible vegetation. The choice of seeding mix will depend on the planned mowing regimen. If the plan calls for frequent close mowing between tree rows (as in a lawn) then a good seed mix would be bluegrass and white clover (low, runner type). If the plan calls for mowing only 2 – 4 times per year then a better mix would be timothy and red clover and/or alsike clover. If possible, this ground cover should be established before the first tree is planted.

Selecting Planting Material

As discussed earlier, hardy Chinese chestnuts (or hybrids with Chinese) from northern sources are the only chestnuts that should be considered for commercial planting in Iowa. They should only come from reputable sources, and they should have superior genetics for commercial purposes: hardiness, blight resistance, nut size and quality, and productivity. There are a lot of nurseries out there eager to sell you chestnuts with mediocre or poor genetics. Avoid them. Consult the Appendix for good sources.

The next step is to choose between seedlings or grafted varieties. Grafted varieties give consistence in productivity, quality and ripening time. They make orchard management easier. On the other hand, grafted trees are much more expensive (\$12 - \$20 each or more), are in short supply, and may have problems with delayed graft union failure, resulting in the loss of the grafted variety. Delayed graft union failure has long been a problem with grafted chestnuts, and has been a major barrier in the development of the chestnut industry in the US. It has been found the best way to reduce the incidence of graft union failure is to graft varieties only on their own seedlings or siblings.

Seedlings are very variable in nut quality, nut size, productivity, and ripening time. Since each seedling ripens nuts at a different time it may be necessary to harvest the whole orchard every day, or every other day, for a month or more. A good compromise solution is to plant a large number of seedlings from superior parents, cull heavily, select the best 5 or 10 individuals once they begin bearing, and graft the remaining trees to those best 5 or 10 trees. Again, it would be important to graft those selections onto their siblings to reduce graft union failure. (Anyone who can whittle a stick with a pocketknife can learn to graft chestnut trees in about 15 minutes).

A very profitable planting could be based entirely on seedlings rather than grafted trees. It would be very important to start with the very best genetics, plant a lot more than you

want to end up with, and cull out the poor performers once they begin bearing. For this type of planting you should probably space the trees 5' apart within the row to start.

In some cases direct seeding may be successful as an economical alternative to planting nursery stock. Hazards which will result in failure of direct seeding include seed drying out (even a little), freezing, and being eaten (by mice, chipmunks, squirrels, deer, and raccoons). If you wish to risk this technique then contact the Southeast Iowa Nut Growers for detailed instructions on how to be successful.

The best varieties for Southern Iowa (either as grafted trees or as parents of seedling plantings) are: "Eaton", "Sleeping Giant", "Mossbarger", "Peach", "Amy", "Orrin", and "Gideon". A newly discovered variety call "Qing" (pronounced "King" or "Ching") may be the best variety in existence, but has not yet been tested in Iowa. Badgersett hybrids are the only viable choice for Northern Iowa. Some varieties to avoid are: the Japanese x European hybrid variety "Colossal" which is popular in California and Michigan (it produces big nuts but nut quality, nut flavor, hardiness, and blight resistance are inadequate), and the Dunstan Hybrids from Florida (they have not performed well this far north). Refer to the appendix for specific nursery stock and seed sources.

Planting, Spacing, and Thinning

Much is written elsewhere about tree planting, and there is no need to repeat it all here. There are a few points worth emphasizing: Nursery stock should be planted in the field at the same depth it grew in the nursery. Planting too deep is the most common fatal mistake in tree planting. Even one inch deeper than nursery depth may be fatal to the chestnut seedling. The planting hole should be large enough to accommodate the root system without bending or crowding the roots. It is better to prune back the roots rather than to bend or crowd them in the hole. Backfilled soil should be firmed around the roots to eliminate air pockets, but without compacting the soil or mashing the root system.

Chinese chestnuts have a mature height and spread of 40'. This means your final orchard spacing should be 40' between rows and 40' within rows. It may take 20, 30, or even more years for the trees to reach this size, so if you start out planting at this spacing you will have a lot of empty, unproductive space for a lot of years. A sensible alternative is to start out with a more dense spacing, such as 20'X20' (for trees which are to be grafted--a spacing of 5'X20' would be better for trees which are to remain ungrafted). About the time the trees begin bearing heavily at 10-12 years old they will have nearly filled up the growing space in the planting. Later, as the trees begin to crowd, every other row can be removed. After another 5 or 10 years every other remaining tree can be removed, and the final 40'X40' spacing will be achieved.

Post Planting Care and Maintenance

Care and maintenance are very important to the establishment of chestnuts, yet this is where the most failures occur. More than half of all tree plantings done by non-professionals fail. The number one reason for these failures is inadequate (or non-existent) weed control. Very few trees will survive in a planting without good weed control. The worst weeds are grasses, and the worst grasses are brome, orchard, and tall fescue (and in that order). They compete with trees for moisture, nutrients, and most of all for growing space for roots between soil particles. Broadleaf weeds compete with trees mainly for sunlight, and then only when they overtop small trees. Weeds need to be controlled at least within 3' of trees during

establishment. Weed control can be accomplished in several ways. The very best way is to use a combination of high quality landscape fabric (a 6'X6' square for each tree, with the tree growing out a slit in the middle of the square) together with a light topping of mulch over the fabric (Figure 2). This method is expensive and labor intensive up front, but if properly done and maintained, it needs to be applied only once. This will save time and money in the long run.

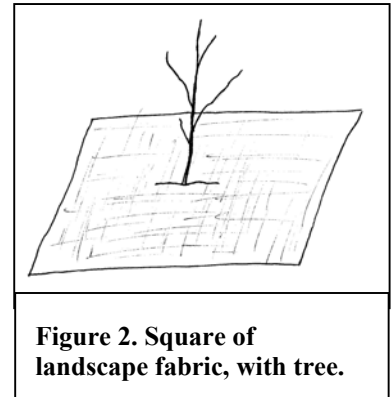


Figure 2. Square of landscape fabric, with tree.

The fastest, easiest, and cheapest weed control is with herbicides. Herbicides should only be applied by professionals with experience applying them on trees. They need to be reapplied every year for at least 5 years. If enough herbicide is used to control the weeds, the trees will be hurt at least a little. If the dose used is small enough to prevent hurting the trees, then the weeds will hurt or kill the trees. Success requires a careful balance.

Mowing at least 2-4 times per year should be done to control the vegetation between tree rows, but mowing by itself is not enough to provide adequate weed control.

Many people attempt weed control by mulching alone. Sometimes it even works. In most cases it requires so much material and labor (64 pickup loads per acre) it just isn't practical on any scale larger than a backyard. If done improperly or with the wrong materials, mulch can cause some severe problems, including total failure.

Another important part of care and maintenance is protecting small trees from damage from deer, rabbits, and mice. In areas where deer are a potential problem (all parts of Iowa, including in town), 5' tree shelters, either fine mesh or solid-vented, offer the most reliable protection. Avoid using solid unvented shelters on chestnuts. That will kill them. An economical alternative to tree shelters is the use of deer repellants. There are a number of fairly effective and long lasting brands on the market. Some can even be used in organic applications. All need to be applied 3-6 times per year (for the long-lasting ones). An effective home made deer repellant spray can be made by mixing one dozen eggs with 5 gallons of water. The mixture must be strained through a window screen before it is put into the sprayer or the sprayer will plug up. This mixture needs to be reapplied every 2-3 weeks, year-round.

In some areas rabbits will cause severe damage to tree plantings. If rabbits are a potential problem then an inexpensive plastic mesh tree shelter 18" tall should be applied to each tree, assuming you don't have 5' shelters on them already (Figure 3). Repellants do not work on rabbits. The rabbit proof shelters cost about 25 cents each. See the Appendix for sources of shelters and repellants.

In some years mouse populations explode. In the winter, the starving mice often girdle small trees below the soil line. The best way to prevent this is to eliminate mouse habitat within the planting by keeping the vegetation between tree rows mowed short (2 – 3 Inches), especially going into the fall.

Protection from fire and herbicide drift may be an important

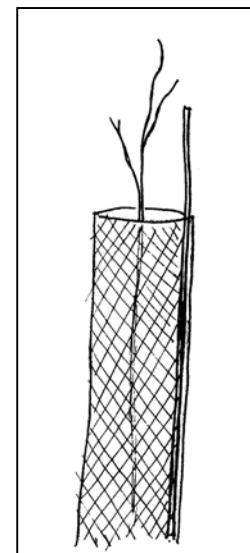


Figure 3. Mesh tree shelter, 18" tall, with stake, provides good protection from rabbits.

consideration in some cases. A good relationship with the neighbor is often the best protection from these hazards. Otherwise a good firebreak at least 20 – 30 feet wide is usually adequate for fire protection. A row of tall, dense shrubs such as honeysuckle or highbush cranberry can be used as a barrier to block and absorb herbicide vapor drift.

A great many insects will feed on the leaves of young chestnuts, but they very seldom are serious enough to need control. Occasionally caterpillars can become numerous enough a treatment with Bt is justified. In very sandy areas of eastern Iowa, especially around Davenport and Muscatine, Japanese beetles may become a serious problem, and will need to be treated with an insecticide.

If chestnuts are well planted and cared for on a good site, within 5 or 6 years they will be large enough to hold their own against deer, rabbits, mice, and weeds.

Potential Disease and Pest Problems

The fungal disease called Chestnut blight is the most serious threat to Chestnut trees. Most, if not all grafted varieties of Chinese chestnuts are resistant or immune to the blight. About 20% of Chinese seedlings will be susceptible. No other species of Chestnut has as high a level of blight resistance, but if you are planting seed or seedlings you need to factor in a loss from blight.

Phytophthora is another fungal disease that can devastate chestnuts planted on poorly drained soil. There is no treatment. The only practical prevention is to plant chestnuts on well-drained soil.

Chestnuts are susceptible to oak wilt disease. It is not known to transmit through root grafts as it does in red oaks. This disease is not considered a serious problem for chestnuts. The best prevention is to avoid pruning, or anything else that will cause sap bleeding from open wounds, between April and July. The sap attracts the beetles that carry the fungus. Several other diseases occasionally damage or kill chestnut trees, but none are considered a serious problem.

Chestnut weevils (two species) are potentially the most serious insect pests for chestnuts in Iowa (Figure 4). Adult weevils lay eggs in developing nuts. The larvae burrow through the kernel and ruin it. In some areas of Southeastern United States the infestation rate approaches 100%. Control with insecticides is possible but difficult. The best control is achieved

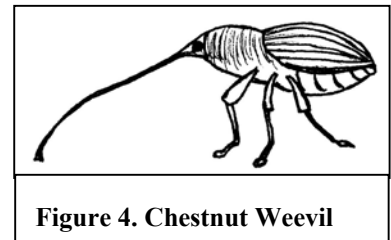


Figure 4. Chestnut Weevil

by allowing chickens to free-range in the orchard, and allow hogs to clean up any nuts missed during harvest. This effectively breaks the weevil's life cycle.

There are no populations of chestnut weevils known to be within a few hundred miles of Iowa (Indiana is the closest). There is no telling when they will even get here, but they probably will arrive someday.

The chestnut gall wasp, which was introduced from Asia, causes severe damage to chestnut trees in Georgia and Alabama. The insect is slowly moving north and west, but will probably never reach Iowa. It is a sub-tropical species and cannot survive harsh winters.

Gypsy moths will probably spread across Iowa someday. In severe infestations the caterpillars can defoliate whole forests, but trees are seldom killed. The caterpillars can be controlled with Bt.

Japanese beetles may cause serious damage in very sandy areas in Eastern Iowa. An application of insecticide may be the only practical treatment.

Once chestnuts begin bearing the nuts will be very attractive to mice, chipmunks, squirrels, turkeys, and deer. Prompt, daily harvesting may be the only way to insure you get your share. A program of population control for the squirrels may also be necessary.

In general, chestnut diseases and pest problems are fewer in number, more manageable, and less serious than for most other crops grown in Iowa.

Pruning and Spraying

Chestnuts are unlike apples, cherries, peaches, and most other tree crops in that they do not need an annual pruning program. Chestnuts need to be pruned to establish a clear trunk up to about 8 feet to facilitate access under the tree for nut harvest (Figure 5). This pruning is done during the initial establishment of the planting, within 5 to 10 years. Try not to prune off more than $\frac{1}{4}$ to $\frac{1}{3}$ of the top in any one year, or the tree may become stunted. Avoid pruning from April through July if possible. Limbs should be pruned when they reach

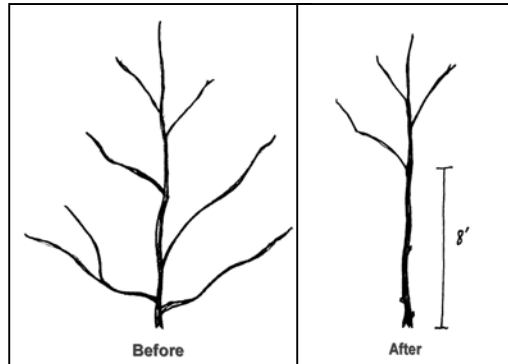


Figure 5. Pruning a chestnut for a clear trunk to 8 feet.

about 1" in diameter. Do not prune limbs flush with the trunk, but instead cut beyond the "branch collar," the swelling at the base of the branch (Figure 6). Once the 8' clear trunk is achieved, the chestnuts need no more pruning.

Chestnuts can easily be grown without spraying for disease or insect control, especially if chickens and hogs are used to control weevils.

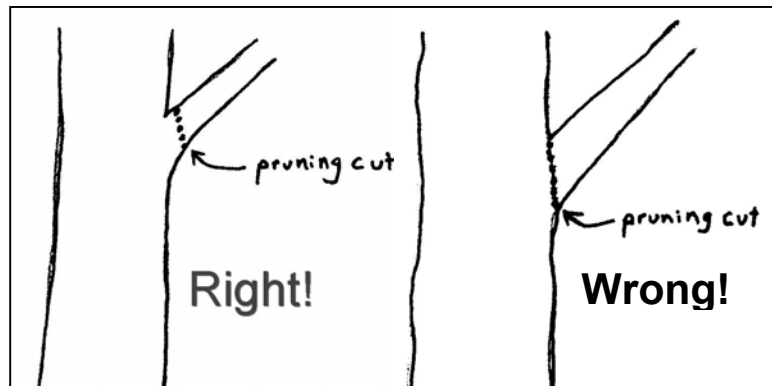


Figure 6. Proper and improper pruning cuts for chestnut limbs.

Mowing

Mowing between tree rows will continue to be important even as the trees mature. Mowing should be done at least 2 – 4 times per year. The most critical mowing is done early to mid September just before nut harvest. Trying to harvest chestnuts hidden in tall grass is impractical if not impossible. It may be feasible to substitute rotational grazing by cattle, sheep, or goats once the chestnuts are mature (15 – 20 years).

Fertilization

Chestnuts can grow and bear profitable crops of nuts without ever being fertilized, but to get the very highest yields a program of regular fertilization will be necessary. Organic fertilizers including finished compost can be used instead of chemicals. Beware of compost made from city yard waste. It often contains substances toxic to trees. If you want to use "city compost" then take a representative sample, place it in a small container, and try growing something like pinto beans in it for a few weeks. If the beans do well the compost is

probably all right. If they fail to germinate or die later, then don't use that compost on your trees. Organic fertilizers from commercial sources should be safe. The higher cost can be easily offset by the higher value (double or triple) for certified organic chestnuts. If chemical fertilizers are used then regular soil tests should determine the quantity and type. Regardless of what kind of fertilizer is used, it should be applied in spring, and never any later than early June. Fertilizer applied later will result in tender late season growth which will be subject to winter damage. Fertilizer (except for finished compost) should not be applied to trees in the year of their planting, but may be started in the 2nd year. A good fertilization program should maximize the trees' growth rate, health, vigor, nut production, and resistance to disease, insects, cold, and drought.

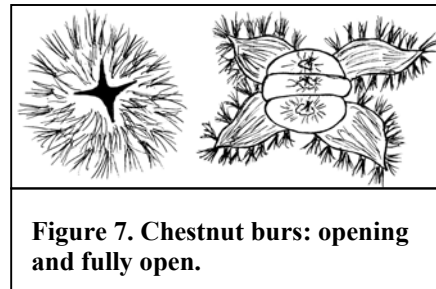
Management of soil pH

In areas with a naturally high soil pH such as Western Iowa and limestone-soil areas in Northeast Iowa, successful chestnut growing may require careful management to bring soil pH down at least to 6.5. On a small scale (a couple of acres or less) this could be accomplished by incorporating partially decomposed sawdust or wood chips (fresh sawdust may be toxic to trees). On a larger scale chemical fertilizers may be the only practical alternative. Fertilizers are so good at acidifying soil farmers are continually adding lime to bring their pH's back up. Ammonium sulfate is probably the best choice of chemical fertilizers for acidifying soil. Avoid aluminum sulfate. Soil tests should be done to determine how much and how often to apply the fertilizer.

Harvesting, Handling, and Marketing Chestnuts

Most seedling chestnuts with good genetics, if well planted and cared for on a good site, should start bearing when they reach 6'-8' tall (about 5 or 6 years). Grafted trees will bear within 2 – 3 years. You should expect marketable quantities (100 pounds per acre or more) within 7 or 8 years, and a mature level of production (1,000 pounds per acre or more) some time between 10 and 20 years (depending on site, management, and the varieties being grown).

Starting in mid-September, the spiny burs which enclose the chestnuts (and protect them from squirrels) will begin to open up (Figure 7). Most of the nuts from any one tree will fall to the ground over a period of 2 – 4 days. If you are growing seedlings, that 2 – 4 day period will be different for every tree, and may stretch from early September to late October. About 15% - 30% of nuts will drop before or after the 2 – 4 day peak. A few nuts get stuck in the burs and drop with the burs



a week or so after the main nut harvest for that tree. If grafted trees are being grown, all the trees from any one variety will ripen their nuts at the same time. When the nuts are falling, chestnuts must be harvested at least every other day, and every day if the weather is warm and dry. Besides the fact that you are racing against the squirrels, if chestnuts lay on the ground for more than two days, they will dry out and be ruined.

Around the world, most chestnuts are harvested from the ground by hand. No mechanical harvesting equipment designed for chestnuts exists yet (though this will probably change). Some alternatives to hand harvest include raking with a plastic leaf rake and

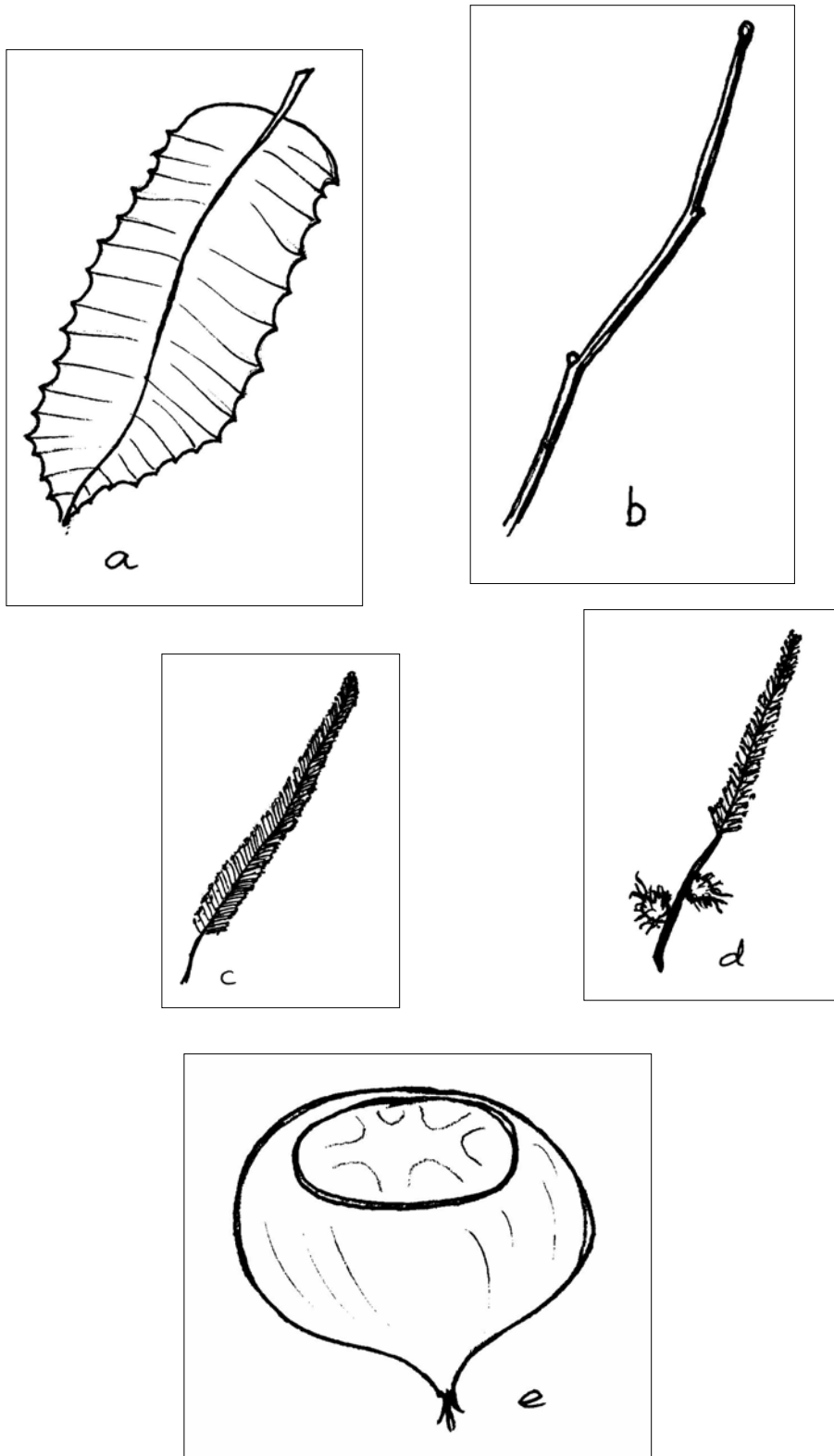


Figure 8. Chestnut parts. a Leaf; b. Twig; c. Male catkin; d. Bisexual catkin with female flowers; e. nut .

Appendix

Sources of Seed/Nursery Stock

Badgersett Research Corporation, Box 141, Canton, MN 55922. www.badgersett.com. Source of the hardiest hybrid chestnuts and hazels available.

Burnt Ridge Nursery, 432 Burnt Ridge Road, Onalaska, WA 98570. 360-985-2873. <http://landru.myhome.net/burntridge/>. Source of chestnuts and many other crop-bearing trees and shrubs.

Empire Chestnut Company, 3276 Empire Rd. SW, Carrolton, OH 44615. www.empirechestnut.com. Source of high quality Chinese chestnut seed nuts and nursery stock.

England's Orchard and Nursery, 316 S. R. 2004, McKee, KY 40447. 606-965-2228. www.nuttrees.net. Source of nursery stock for chestnuts and other tree crops.

John H. Gordon Jr. Nursery, 1385 Campbell Blvd., Amherst, NY 14228. <http://geocities.com/nuttreegordon/Okgordon.htm>. Source of seed, scionwood for grafting, nursery stock, and literature for chestnuts and a wide variety of other tree crops.

Nolin River Nut Tree Nursery, 797 Port Wooden Road, Upton, KY 42784. 270-369-8551. www.nolinnursery.com. Source of the widest selection of nut tree nursery stock available.

Red Fern Farm, 13882 I Ave, Wapello, IA 52653. 319-729-5905. www.redfernfarm.com. Source of high quality, low priced, locally grown nursery stock for chestnuts and a variety of other crop-bearing trees and shrubs.

Sources of Equipment/Supplies

A. M. Leonard, 241 Fox Dr. Piqua, OH 45356-0816. 800-543-8955. www.amleo.com. Source of horticultural tools and equipment.

Central Landscaping, 4026 County Road 74 South, St. Cloud, MN 56301. 800-772-3888. www.centrallandscape.com. Wholesale only (you must be a business) supplier of lawn, garden, and landscape equipment. Low cost source of deer repellants.

Forestry Suppliers Inc., PO Box 8397, 205 West Rankin St., Jackson, MS 39201 800-360-7788. www.forestry-suppliers.com. Retail supplier of a wide variety of tree-related equipment and supplies, including deer repellents, landscape fabrics, and tree shelters.

Books

Tree Crops by J. Russell Smith. Out of print, but available all across Iowa through inter-library loan.

Permaculture: A Designer's Manual by Bill Mollison. Available from Good Earth Publications, (704) 863-2288, or through inter-library loan.

Nut Tree Culture in North America, Edited by Richard Jaynes, published by the Northern Nut Growers' Association. Out of print, but available through inter-library loan.

Nut Growing Ontario Style by John H. Gordon Jr. Available from the author for \$12.95 post paid, at 1385 Campbell Blvd., Amherst, NY 14228-1404. Also available through inter-library loan.

Organizations

ATTRA, Appropriate Technology Transfer for Rural Areas, PO Box 3657, Fayetteville, AR 72702. www.attra.org. Lots of good, free information. Ask for Materials List at 800-346-9140.

Iowa Nut Growers Association. \$10 per year to Doris Kentner, Membership Secretary, 116 N. Dewey, Osceola, IA 50213. Good source of information on growing a wide variety of nut trees.

Nebraska Nut Growers' Association. \$10 per year to 122 Mussehl Hall, UNL East Campus, Lincoln, NE 68583-0716. Good source of information, seed nuts, and scionwood for grafting (but not much on chestnuts).

Northern Nut Growers' Association. \$20 per year to Nancy Petitt, Treasurer, PO Box 550, Townsend, DE 19734-0550. www.northernnutgrowers.org. Excellent source of information.

Practical Farmers of Iowa. \$25 per year to PFI, 2035 190th St., Boone, IA 50036-7423. A network of progressive farmers interested in sustainable agriculture and involved with a wide variety of cutting-edge practices and enterprises (including chestnut growing). One of the most respected and admired sustainable agriculture groups in the world.

Southeast Iowa Nut Growers. 13882 I Ave. Wapello, IA 52653. (319) 729-5905. redfernfarm@lisco.com. Organization of mostly chestnut growers and marketers. They are the sponsors of this primer, and the best source of information about growing chestnuts in Iowa.

National Agroforestry Center, East Campus – UNL, Lincoln, Nebraska 68583-0822. Phone: 402-437-5178; fax: 402-437-5712. Publish a number of technical bulletins on incorporating trees into agriculture.

Southeast Iowa Nut Growers

C/O Tom Wahl

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