

The WESTERN CHESTNUT

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Summer2001

California Orchard Tour Promises to be Late Summer Highlight

Harvey Correia, WCGA Board member, and Lorin Amsberry, of Fowler Nursery, have been working hard to ensure an orchard tour for early September that will be both educational and enjoyable. Scheduled for Friday and Saturday, September 7-8, there will be visitations to 5 or 6 orchards in the Linden/Modesto area, and Dr. Kay Ryugo, retired UCD professor, will direct a tour of the U.C. Davis chestnut plantings.

Angelo Ibleto promises another of his famous barbecue dinners on Friday evening. The cost of the weekend meeting, including dinner, will be \$35, and must be sent to the treasurer, Ray Young, with the reservation form to be found on p. 5. Call Harvey at 916-777-4152 or email him at harvey@Chestnutsdirect.com.

Those who are planning to fly should plan on using the Sacramento airport. The Best Western Stockton Inn will be the headquarters motel.

See p. 5 for more details.

NNGA 2001 Meeting To Be Held August 5-8, 2001

The 92nd NNGA Annual Meeting will be held at Cornell University in Ithaca, New York from August 5-8, 2001. Information can be obtained from the NNGA website at <http://www.icserv.com/nnga/index.html>. To receive additional information about this meeting, put "NNGA Annual Meeting" in the subject header of an e-mail to icomserve@aol.com. It should be an informative week for all who attend.

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More Information on Chestnuts And Ink Disease

by Anthony Boutard

Ink disease is a serious and often fatal root disease in the American Chestnut (*Castanea dentata* (Marsh.) Borkh.) and European chestnut (*Castanea sativa* Mill.). Symptoms appear in the spring with trees producing smaller than normal and yellowish leaves. Declining vigor is associated with the loss of fine roots, followed by the gradual girdling of the stem collar. Beneath the bark at the base of the tree the tannins in the dying tissue are blackened, hence the common name for the disease. At the time the symptoms are visible, the tree may have been infected for several years.

The disease is thought to have been brought to the southern United States in the early 19th century, possibly on exotic ornamentals. From there it spread northwards killing large mature American chestnuts (Crandall et al. 1945). In 1932, Margaret Milburn and G.F Gravatt, researchers with the USDA, described the causative organism as a species of *Phytophthora*. Later, *Phytophthora cinnamomi* Rands, was isolated as the species causing the disease in native chestnuts and chinquapins.

In Europe, also in the early 19th century, a similar disease was noted first in Portugal,

and then Italy and France. The French mycologist, Delacroix (1897), observed that certain varieties and grafted trees are especially susceptible to the disease. In Oregon, grafted trees also seem particularly vulnerable (R. Coleman, pers. comm.). The causative organism in the European chestnuts, *Phytophthora cambivora* (Petri) Buis, was described by the Italian pathologist Petri in 1917.

Both species of *Phytophthora* are now found in the United States, Europe, Great

Britain and Australia. In southern Australia, a similar disease in chestnut is caused by *P. cryptogea* Pethybridge and Lafferty (Wicks and Vole 1976).

The Chinese (*Castanea mollissima* Blume) and Japanese (*C. crenata* Sieb. and Zucc.) chestnut species are generally considered resistant to ink disease caused by *Phytophthora cinnamomi* and *P. cambivora* (Crandall et al. 1945, Day 1939). The Euro-Japanese hybrids vary in susceptibility, with "Bouche de Bétizac" showing good resistance (Breisch 1995).

The Japanese chestnut is susceptible to *Phytophthora katsurae* Ko and Chang (Erwin and Ribeiro 1996), which causes a disease with symptoms similar to other *Phytophthora* species. Thus far, the disease with respect to chestnuts is limited to Japan, but that can change by some lapse in our quarantine rules. The same species also causes heart and fruit rot in coconuts, and is a serious problem in Hawaii.

Genus *Phytophthora*

The genus *Phytophthora* was first described in 1876 by Anton de Bary who identified the organism responsible for the devastating late blight of the potato. The Greek-based epithet means "plant destroyer." D.C. Erwin and O.K. Ribeiro (1996) describe 59 species within the genus. They are primarily tropical and subtropical in distribution, favored by warm, wet conditions.

Although *Phytophthora* and the closely related genus *Pythium* are often referred to as "fungi," they are fundamentally distinct from true fungi and have been proposed as a separate kingdom, "Chromista," which

See *Ink Disease*, p. 7



Symptoms appear in the spring with trees producing smaller than normal and yellowish leaves.

A MESSAGE FROM THE PRESIDENT

Interesting things are happening in the chestnut business. You will see elsewhere in this edition of the newsletter that a meeting was held at Michigan State University to discuss chestnut quality standards. There have been some sizable chestnut plantings in Michigan and growers and the proponents of the project are exploring some potential ground rules to handle the marketing of this crop as the production increases in the next few years.

Several growers represented the WCGA from Washington, Oregon and California. We feel that it is very important to be involved in the early stages of these meetings so that the areas currently producing chestnuts have their interests represented. The interests of current growers should be fairly reflected in any regulations that are adopted.

The general feeling of the more established growers is that there is a market for all of the current production plus that from the newly planted orchards. There may be a time, however, when an unusually large crop may create a short-term surplus. With this in mind some growers are exploring the development of added value products such as dried, peeled or frozen chestnuts. Recently there have been many articles in the food, nutrition and restaurant press on chestnuts. These are very helpful and can expand the market for our product. The added value products will allow a lengthening of the season due to their storability and expand the market because of their convenience to the end user.

The summer field day is taking shape and it will be fun and informative. Harvey Correia has worked hard putting together the details and I hope that many of you will be able to attend. Pull together your questions and perhaps you will get some answers. It is always helpful to visit other orchards even if it only convinces you that what you are doing is better for your situation. This newsletter has more specific information on the tour in another article.

Our trees are doing quite well. There is minimal shot hole borer damage this year and most of them are getting out of the reach of the occasional deer that gets through the fence. They are about to bloom and there are many female flowers forming on the branches. If the weather is favorable during pollination we could have a good crop.

I hope to see many of you in California in September.



EDITOR'S NOTES

WCGA is lucky indeed to have not only knowledgeable members, but members who are willing to share with others. In this issue you will enjoy Anthony Boutard's well researched article on phytophthora that provides some ideas for inhibiting its spread.

Jeff Olsen, OSU Extension Horticulturist, has provided us with a review of the leaf analysis project begun last year and offers some insight on the meaning of the results obtained. As we continue to collect data this year results will be increasingly useful.

Members, Harvey Correia, Chris Foster and Steve Jones, participated in a meeting at MSU organized by Dr. Dennis Fulbright to take a look at quality standards from a national perspective. You will find Chris' report of interest.

Plans are currently being firmed up for another outstanding orchard tour to be held on Friday and Saturday, Sept. 7 and 8. See details in this issue.

See you in California!



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Regular membership is \$20 per year per person. Members receive The Western Chestnut quarterly. For foreign delivery contact Editor for pricing. Back issues may be obtained by members. Membership applications may be obtained from the Secretary-Treasurer.

POSTMASTER

Send Address changes to WCGA, c/o PO Box 841, Ridgefield, WA 98642.

ADVERTISING RATES

Full page, camera ready (w/1 photo) .. \$15.00
Half page, camera ready (w/1 photo) ... 10.00
Quarter page 7.50
Business card (4 issues) 10.00

One classified ad per member per year is free (max 6 lines, \$2.50 ea add'l 6 lines). Ad space may be reserved with full payment but must meet established deadlines. If ad is cancelled, money may be refunded if space is resold. Make checks payable to Western Chestnut Growers Assn., Inc.

All ads and other copy preferred in PC format on disk or e-mail to Carolyn@ChestnutsOnLine.com. Ads must adhere to published ad sizes for space purchased. Call for specifics. Otherwise for best results, submit original photographs. Layout of ads will not be done until payment is received. **Send materials to P.O. Box 841, Ridgefield, WA 98642, or Fedex/Express Mail to 29112 NW 41st Ave., Ridgefield, WA 98642.** Call for further info.

PUBLICATION AND DEADLINES

Fall issue	deadline 9/10	mailed 10/1
Winter issue	deadline 12/10	mailed 1/1
Spring issue	deadline 3/10	mailed 4/1
Summer issue	deadline 6/10	mailed 7/1

EDITORIAL OPINION

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WCGA Well Represented at Michigan State University Meeting on Quality Standards

June 16 National Meeting a Successful Start

by Christopher Foster

Earlier this year, Dr. Dennis Fulbright and fellow colleagues invited a diverse group of chestnut growers from throughout the U.S. to the campus of MSU in East Lansing Michigan for a nationwide meeting. Not since 1992, has there been such an exchange or meeting of growers on a

ing efforts, grant proceeds have been used to purchase an Italian processing line which peels fresh chestnuts. Several of the professionals working in the different disciplines participated in the meeting. Dennis reports that a fourth and much

of their depth of experience with chestnuts specifically. Most participants had already discussed the general topics with fellow growers in their own region, had come prepared, and were there to share views. Attendees from the West Coast included Steve Jones from Washington, Chris Foster from Oregon, plus Harvey Correia and Lucienne Grunder of California.

Phil Eastman of the USDA Standardization Section for Fresh Fruits and Vegetables headquartered in Washington D.C. explained the values and process of adopting national grading standards for fresh product. Adopting Standards is a voluntary program that must be initiated by a consensus of producers. It is not generated or driven by the USDA, but rather by the industry in an effort to speak a common language throughout the country to expedite and assist sales. The Standardization Program receives no government ap-



Dennis Fulbright addresses participants at the MSU meeting. At left are Steve Jones and Lucienne Grunder, WCGA members.

nationwide basis. The purpose of the meeting was to discuss the willingness of growers in adopting a common language in the trade or sale of chestnuts through USDA Standards, and to explore the interest in promoting marketing on a regional or possibly national scale. The meeting was funded by a portion of grant proceeds, which were passed through to Dennis's group by the Mid-West Nut Producers Council. The origin of the grant was the USDA Federal/ State Marketing Improvement Program. Significant financial help also came from the "hibernating" Chestnut Marketing Association originally formed in 1992 and currently under the care of Dr. Greg Miller. To stimulate the conversation, professional experts gave talks on a range of topics.

Fulbright and his associates have been successful in obtaining three grants, each from different sources, combining in the multi-disciplinary effort to get a chestnut industry up and running in the Midwest with the help of University professionals. Besides horticultural research and market-

larger proposal is currently pending with yet another USDA source. This program would link various parts of the country in a broader effort including affiliates in the West through the Extension Service programs at Oregon State University and UC Davis. Jeff Olsen of OSU and Paul Vosen of UC Davis (both Extension agents) have agreed to participate and are specifically named in the grant proposal.

The meeting began at 9:00 AM with introductions of participants. All 13 individual growers talked about their experience and marketing efforts, from a few fairly new to the business, to those like Dr. Greg Miller who has been involved with chestnuts, chestnut research and chestnut marketing most of his life. Several of the participants had broad agricultural experience, which furthered the conversation. Others made thoughtful and articulate contributions to the discussion, regardless

There was solid objection to any rule, which on the whole, would kill diversity, identity, and regionalism in the marketplace.



Chris Foster, Harvey Correia, a Michigan grower, and Lucienne Grunder stand in front of a 1992 Colossal which is part of the variety trial at the Benton Harbor, MI, experiment station.

propriations, being supported entirely by user fees. Inspection services are conducted by professionally trained state employees through a USDA/ State contract program. Qualifying product is issued a certificate of compliance with legal clout. Phil explained the various phases in developing and adopting standards in coordination with the USDA. The process begins

Continued on next page

Continued from p. 3

with a formal request by growers followed by a combined effort in gathering information including market surveys. A rule is proposed and a comment period follows. A final rule is then adopted and printed in the Federal Register. Dennis then led a discussion about common language and standards used for chestnuts in other parts of the world. Growers expressed their own viewpoints on what elements might be appropriate for USDA grading standards. While common sizing terminology was definitely thought to be important, most growers expressed some reservations about making

size the only grading standard. Many thought USDA standards should focus on defects, and have size and variety included as a "USDA labeling requirement". There was solid objection to any rule, which on the whole, would kill diversity, identity, and regionalism in the marketplace.

The afternoon session focused on marketing. Dr. Christopher Petersen, Agricultural Economist from MSU spoke on maintaining profitability through grower control of production and marketing systems. Petersen described two strategic business models or game plans for maintaining profitability. The first and more traditional method in agriculture was termed the "commodity strategy". Briefly, this is an attempt to increase profitability by focusing on lowering production costs internally. This scenario often results in the treadmill of lower and lower prices for the grower, in an attempt to stay competitive. "Price" becomes everything. The alternative business plan was termed the "value-added strategy". Under this model, growers focus more on the needs, benefits, and criteria that their customers perceive as desirable. Further, there is an on-going effort to maintain the uniqueness of each grower's product and service. While internal costs are important, they are down the list somewhat, and tempered by other factors. Dr. Petersen thought it was important for growers to have some sense

of which strategy they want to use, and that a blend of the two would be difficult to manage. Tom Kalchick of the MSU Extension Service went on to explain the concept of co-ops in an attempt to maintain profitability. Aside from pooling assets for capital and marketing costs, they are exempt from anti-trust laws, allowing grow-

co-operation and trust.

On Sunday, Dennis drove a few of us to the Benton Harbor Research Farm in southwest Michigan to view a small chestnut trial planting. The first trees, including a few Colossals from Fowler Nurseries, were planted in 1992. Last year, one of the Colossals reached 50 lbs. of production despite enduring extended wintertime tempera-



Phil Eastman of the USDA addresses the group.

ers to set prices in their common interest. There is currently a steering committee of midwest growers exploring the possibility of forming a regional co-op. Growers from other parts of the country thought that the regional approach, rather than a national effort was best for the current situation.

The meeting closed at 7:00 PM with a discussion of "where do we go from here". A summary of the meeting will be published and made available for those not in attendance. It was thought that the upcoming WCGA Orchard Tour might provide an opportunity for a representative from each regional chestnut grower organization to further the discussion, particularly on Standards. With the help of the Internet, we hope to keep the conversation going in building

In the "commodity strategy" price becomes everything. In the "value-added strategy" growers focus more on the needs, benefits, and criteria that their customers perceive as desirable.



Dennis Fulbright points out a Colossal tree planted in 1992 at the MSU research farm near Benton Harbor.

tures well below zero. This has become the "target" figure for the Michigan growers who have been planting Colossal. Dennis reports that there are about 3000 of this variety in the ground in Michigan, with more on the way.

□□□

Trivia Corner
Did you know that WCGA now has 91 members living in 13 states?

WCGA Orchard Tour

Sept. 7-8, 2001

The Orchards:

Thursday, Sept. 6

Meet at the Stockton Inn lobby at 8:00 PM

Friday, Sept. 7

John DeMartini's orchard and processing facility

Nick Genetti's established Colossal orchard

Joe Machado's young 10-acre Colossal orchard

Cliff Acosta's young Colossal orchard

Lucienne Grunders 80 acres of '98 seedlings grafted to Colossal and numerous European varieties

Joe Avila's mixed-age orchard and new processing equipment

Saturday, Sept. 8

Harvey Correia's young, below-sea-level Colossal orchard

Tour the UC Davis farm with Dr. Kay Ryugo to see the chestnut plantings there.

Catch any stops missed the day before.

There may be other stops to look at European varieties

Special guests will be with us including Dr. Dennis Fulbright, MSU, Neal Van Alfen, Dean of the School of Ag & Env. Science at UC Davis, Kay Ryugo, retired UC Davis professor.

See map on reverse side



The Friday Night Dinner

We will be fortunate once again to have our dinner catered by Award Winning Chef Angelo Ibleto, WCGA member from Petaluma. You will remember the sumptuous dinner he did for us at the last California tour. This is one you definitely won't want to miss

Menu

Appetizers

Salad

Tri-tip Steaks

Beverages

Headquarters Motel: Best Western Stockton Inn, 4219 Waterloo Rd., Stockton, CA, (877) 293-8697. Rates \$68. There will be a brief meeting Thursday evening, 8:00 PM in the lobby to discuss the details of the tour.

Suggested Airline: Alaska Airlines is currently the least expensive from the Northwest to Sacramento.

Cost Per Person

Cost for the tour and dinner is \$35 per person
Reservations limited to the first 40 people.
Reservations must be received
no later than Aug. 28

Information

Contact Harvey Correia

Phone: 916-777-4152

Fax: 916-777-4495

Email: harvey@Chestnutsdirect.com

Clip here and mail with your check

Reservation Form

Name(1) _____

Name(2) _____

Address _____ City _____ State _____ Zip _____

Phone _____ Email _____

Number of reservations _____ * \$35 each = _____

Send your check for each person attending made payable to **Western Chestnut Growers' Assn., Inc.**, to
Ray Young, Treasurer, P.O. Box 841, Ridgefield, WA 98642

Orchard Tour

The map below locates the Best Western Stockton Inn (headquarters motel) and also the Fruit Bowl, where we will meet on Friday morning to begin the tour.



Headquarters Motel: Best Western Stockton Inn, 4219 Waterloo Rd., Stockton, CA. Meet here at 8:00 PM Thursday evening (9/6) to discuss the tour the following day. Phone is (877) 293-8697. Room rate is \$68.00.

The Fruit Bowl: 8767 E. Waterloo Rd., Stockton. Phone is 209-931-1196. It's about 3 miles east of Hwy. 99, east of Alpine Rd. but west of Pezzi Rd. Meet on Friday morning at 8:00 AM to begin the tour. The Fruit Bowl has good pastries and breakfast. They open at 6:00 AM.

Survey Reveals Interests

At the February annual meeting and again in the Spring edition of this newsletter members had an opportunity to make their interests known through a survey that was distributed. The results of that survey will help the Board of Directors as they plan meetings and other activities, and will help the Editor in selecting articles for publication.

There was overwhelming support (65%) for having an orchard tour in conjunction with the annual meeting, and just as much interest in having a demonstration of harvesting equipment. Fifty nine per cent of those responding supported the idea of alternating the annual meeting between California and the Northwest. The idea of having a taste test received much support as did having a grafting workshop.

Most members preferred a Saturday meeting and indicated a preference for a full day meeting including continental breakfast and lunch.

You may recall that the second half of the survey asked members to prioritize those topics that they would like to see addressed either at a meeting or as articles in the newsletter. The topics chosen most frequently follow with those receiving the greatest number of votes shown first: refrigeration, packaging, what doesn't work, fertilization, sorting nuts, pricing, orchard maintenance, pruning, harvesting equipment, shot hole borer, phytophthora, quality standards, peeling, managing the harvest, pollination, drying, soil analysis, your orchard and the IRS, varieties, selling at farmers' markets, processing methods, blight, on farm sales, foliar analysis, pesticides, and educating consumers.

If you should run across an article on one of these topics that you feel would be of interest to the membership don't hesitate to pass it on to your Editor. Remember that we must have permission to reprint anything that is copyrighted, so make sure to include the publication information.

□□□

Make your reservations now for the September Orchard Tour in California.

Ink Disease, *from p. 1*

includes the brown algae and mildews (Erwin and Ribeiro 1996). *Phytophthora* has four different life stages: zoospore, chlamydospore, oospore and mycelium.

The mycelium is the growing and reproductive stage of the organism. When a chestnut tree is dying, mycelia are present and growing in the roots and the base of the stem. In *Phytophthora*, the mycelium is a continuous, branching tube and does not have the regular divisions, or septa, which characterize fungi. The cell wall is chemically distinct from the fungi clan, lacking the chitin which distinguishes fungal cell walls (Bartnicki-Garcia and Wang 1983).

The branching tubes of the mycelial stage, called hyphae, give rise to spore bearing structures. Unlike true fungi which spread via mycelial growth through the soil, the mycelium of *Phytophthora* is poorly adapted to life apart from the hosts. *Phytophthora cambivora* and *P. cinnamomi* are considered "weak saprophytes" (Weste 1983). That is, the mycelium can live off of dead organic material in the soil and persist in this state under a narrow range of conditions. Dispersal and long-term persistence of *Phytophthora* is largely caused by spores, though some tree-to-tree mycelial movement might happen (Weste 1983).

Chlamydospores and oospores are the resting stages which are resistant to hostile environmental conditions and germinate under suitable conditions. They do not actively move. They are transported when infected soil or diseased plants are moved. For example, muddy logging equipment is the reason *P. lateralis*, the species which kills Port Orford cedar, spread so quickly through the forests of coastal Oregon.

Zoospores actively move. They have two tail-like structures called flagella. One is long and whiplike, the other is shorter and bears hair-like bristles, or tinsel, along its length. By means of the flagella, the zoospore moves upward in the soil water, which can position them in surface water. In some areas, the spread of the disease is associated with water channels, such as irrigation and drainage ditches, and culverts. The zoospores of *P. cinnamomi*, in particular, are strongly attracted to ethanol (Carlile 1983), which is released by roots during periods when they are waterlogged. They are also attracted by substances exuded by roots as they grow.

The zoospore will become a cyst by developing a resistant cell wall and shedding its flagella within minutes if conditions are not favorable. The cyst can later regrow flagella, or produce an infection tube if a host is near. Infection tubes penetrate the plant tissue. Germination of spores is thought to be triggered by root exudates (Malajczuc 1983).

Management considerations in controlling *Phytophthora* infection

What follows are actions which can help control ink disease in chestnut groves and orchards.

1. Sanitation

Sanitation is the first defense against *Phytophthora* infection. It is best to



Note healthy leaves at left, leaves from tree infected with phytophthora at right.

avoid sources of infection, such as the soil on the roots of nursery stock, or equipment and tools, which carry soil from an infected location. If your trees show no symptoms it is not a guarantee that the orchard soil is uninfected, so careful sanitation is always worth practicing.

Ink disease is a root and root collar disease, and there is no suggestion in the literature that the disease can be spread by scion wood from infected trees, though common sense tells us that it is unwise to use wood from anything less than a vigorous tree. On the other hand, the graft union can be an avenue for infection, especially if it is near the base of the tree.

I suspect the susceptibility of grafted trees lies in the physiology of the graft union which may create stress in the plant during the early spring surge of growth, perhaps leading to a buildup of ethylene. Recall, both shot hole borers (*Xyleboris dispar*

Fabricus) and *Phytophthora* zoospores are attracted to ethylene, and shot hole borers also favor grafted trees.

When trees display ink disease symptoms, avoid moving the soil from the infected area to other parts of the orchard, and clean boots, equipment and tools immediately after removing any diseased tree. For most growers, it is sufficient to rely on the symptoms for diagnosis, as certain identification of *Phytophthora* requires culturing the organism in the laboratory. The symptoms include yellowed leaves, leaves smaller than in a healthy tree, and reduced growth of the stems. Cankers may be visible at the base of the tree. According to Christopher Foster of Cascadian Chestnuts, the lack of suckers on a declining tree is a sure sign of advanced ink disease, and signals that it is time to remove the tree.

2. Drainage

Water is the most critical factor in the ability of *Phytophthora* species to attack plants (Duniway 1983, Erwin and Ribeiro 1996). Wet, waterlogged soils are closely associated with ink disease in chestnuts (Day 1938, Delacroix 1897, Erwin and Ribeiro 1996). Under waterlogged conditions, actually in the absence of oxygen, the process of glycolysis is disrupted and ethanol builds up in the root tissue and is released into the surrounding soil and air (Salisbury and Ross 1978). As mentioned earlier, zoospores of *P. cinnamomi* have been shown to swim towards an increasing concentration of ethanol.

Because of the importance of free water in the onset of disease, maintaining good drainage, especially around the root collar, is a critical step in controlling *Phytophthora*. In establishing new plantings, some growers create a mound five to ten inches above the general soil level to insure good drainage at the root collar. Avoid planting in low or springy areas with a high water table.

3. Avoid damage to roots, soil compaction and drought stress.

Disking and harrowing within the root zone of the tree can increase vulnerability to *Phytophthora* infection (Portela et al. 1998). Not only does the activity pose the potential of moving spores around the orchard, the disc itself injures feeder roots, providing an avenue for infection. Unlike hazelnuts, which in the wild are trees of dis-

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Continued from p. 7

turbed habitats and hedgerows, the chestnut is a forest tree and far less tolerant of root disturbances.

Guido Bassi, who grows grafted chestnuts for European orchards, watched a young orchard he had provided trees for develop into a healthy stand of trees. Around ten years old, when the orchard started to bear commercial quantities of nuts, the owner disked beneath the trees to make nut collection easier. Shortly afterwards, trees started to die from ink disease. Bassi notes that the owner immediately blamed the nursery stock, rather than his change of management regime.

Repeated entries with tractors, trucks and other machinery can lead to compaction of the soil which impedes the downward flow of water. Even on a well tiled field, compaction can lead to waterlogged soils and a good environment for *Phytophthora*. Avoid driving high ground pressure equipment, such trucks and tractors, in the orchard, especially when the soil is wet. Encourage the growth of deep rooted vegetation such clovers, bell beans, lupines, dandelions, chicory, mustard and rape, which help prevent and reverse soil compaction. Mow later in the season when the soil is dry and the desirable plants have gone to seed.

Drought stress has also been observed to predispose trees to ink disease (Portela et al. 1998). In most locations of the Pacific Northwest, irrigation is essential for a chestnut orchard of good vigor.

4. Build a “Suppressive Soil.”

In the late 1960s, Ken Baker, a pathologist at the USDA lab in Corvallis, was lecturing in Queensland, Australia. Ink disease is a serious problem in avocado groves there and in the US. He heard about a healthy avocado grove free of ink disease mortality, even though it was surrounded by severely infected and declining groves.

Ashburner, the farmer who owned the grove, had read that avocados are rain forest trees and methodically managed his soil to replicate certain characteristics of those forest soils (Baker 1978). The “Ashburner System” entails the regular application of poultry manure and calcium (via lime), and the use of legume cover crops. The goal was to build up the organic matter, nitrogen and calcium in the soil.

Baker and others studied Ashburner’s soil and found that *Phytophthora* was present, but its growth was suppressed.

Their research showed that this suppressive quality was destroyed by sterilizing the soil, pointing to soil organisms as a factor in suppression. Some soil organisms are antagonistic to the growth and survival of *Phytophthora*, and others feed on the mycelium and spores of the organism. A diverse and vigorous soil life reduces the number of spores in the soil which remain viable for the next wet season.

Organic matter is essential for soil life, and an abundance of organic matter in the soil increases numbers and diversity of the organisms. The composition of organic matter is also important. Organic matter from legumes appears to provide greater suppression of *Phytophthora* (Malajczuk 1983).

In addition, organic matter encourages the growth of mycorrhizal fungi. Italian researchers have shown that mycorrhizal fungi help protect chestnuts against *Phytophthora cinnamomi* and *P. cambivora* (Branzanti et al. 1999). The research suggests that mycorrhizae may inhibit zoospore germination in the root zone, possibly by absorbing the root exudates which trigger spore germination. Mycorrhizal fungi are also beneficial to the health of the tree. The fungi consume root exudates and, in turn, provide the tree various nutrients from their vast mycorrhizal network, trace minerals and water, in effect extending the root system far beyond the actual root. There are mycorrhizal root dips commercially available, which may offer one more line of defense against the root disease.

In the late 19th century, Delacroix noted that the ink disease was prevalent in siliceous soils and absent from calcareous soils (1897). It appears that the inhibiting factor is the calcium, not the higher pH usually associated with calcareous soils. Gypsum is the preferred source of calcium for chestnuts as it does not raise the pH of the soil.

Randy Coleman, a chestnut grower in Oregon, credits gypsum for halting *Phytophthora* infection in his orchard, and has even seen the reversal of symptoms in some infected trees (pers. comm). After delivering several loads of gypsum to raspberry researchers in Vancouver, WA, Coleman, a lime and gypsum applicator, asked them what they were doing with it. They explained that gypsum is effective at reducing root rot problems in raspberries caused by *Phytophthora fragariae* var. *rubi*. Because it moves slowly in the soil, gypsum is best applied on an annual basis in advance of problems.

Christopher Foster uses composted chicken manure from Stutzman (Canby, Oregon) to treat infected trees and the soil where infected trees have been removed. Stutzman’s is composted with gypsum, so it is high in calcium.

5. Resistant varieties

As noted in the introduction, Japanese and Chinese chestnuts are regarded as resistant to ink disease. Some of the Euro-Japanese varieties have also been evaluated for resistance to the disease. The Interregional Research and Experiment Center for Fruit Growing at Douville, France, has long-term trials evaluating the resistance of established and new varieties to ink disease. Perhaps results will be reported at the next international chestnut congress. Unfortunately, in the western US, there are no such systematic trials under way.

The Euro-Japanese hybrids “Marsol” and “Bouche de Bétizac” are available in the US and have good resistance to the disease. These varieties also produce good nuts, and “Marsol” is a pollinizer.

A cautionary note regarding resistance is important to include. When Day (1939) conducted his inoculation experiments, he found the Japanese varieties of chestnuts to be susceptible to *Phytophthora cambivora*, *P. cinnamomi* and *P. syringae*, even though, in the field, those varieties showed good resistance. This suggests that the exposed tissue is susceptible, and that management activities which wound the trees may lead to the disease.

Conclusion

Ink disease in chestnuts is geographically well distributed and has been reported from Europe, United States, New Zealand and Australia on European (*Castanea sativa*) and American chestnuts (*C. dentata*). A similar phytophthoran disease is found on the Japanese chestnut (*C. crenata*). Associated with wet soil conditions, the disease is best controlled by careful management of the grove. This includes limited use of machinery in the orchard, and the maintenance of high levels of organic material and calcium.

Another possible *Phytophthora* disease looming on the horizon is the “sudden oak death” syndrome which is affecting oaks in California. It is considered a newly evolved disease. The cankers appear high on the tree and the death of the tree, as the name suggests, is very rapid once symptoms appear. Currently, it limited in distribution, mostly infecting the live oak, tanoak and black oak groves in coastal California, but as chestnuts are in the oak family, they may be susceptible.

See Ink Disease, p. 11

Leaf Analysis Important in Managing Nutrition in the Chestnut Orchard

By Jeff Olsen, Oregon State University Extension Horticulturist

During this year's Western Chestnut Growers Annual Meeting in Portland I gave a talk on using leaf tissue analyses to manage chestnut orchard nutrition. I was asked to write an article on this topic for the newsletter. At this point, it seems that very little is known about proven critical levels of the various nutrients in chestnuts. As a result our local growers began establishing a database of leaf tissue analyses results on their orchards, which are listed in Table 1. Over time this will give us all a better idea of the range of results so that we can adapt a set of reasonable recommendations for chestnuts.

Leaf tissue samples should be taken from the orchard in the month of August. You need 50 leaves per sample. Some growers take these randomly throughout the orchard. Some mark sample trees and return to those same trees every year. Every OSU Extension office has leaf tissue sample kits. If you send your samples to Corvallis, I will get an electronic copy of your results and would be glad to help you interpret them. If they are sent to a private lab, send copies of the results to me at: Jeff Olsen, OSU Extension Service, 2050 Lafayette Ave., McMinnville, OR 97128.

Table 1. Recorded leaf tissue results for Pacific Northwest chestnut orchards in 2000.

	N % dry wt.	P % dry wt.	K % dry wt.	Ca % dry wt.	Mg ppm	B ppm	Zn ppm	Mn ppm	Cu ppm
Portland, OR	2.57%	0.20%	0.92%	0.79%	.25	73	29	462	9
Gaston, OR	2.72%	0.23%	1.02%	1.00%	.22	63	70	675	10
Gaston, OR	2.68%	0.30%	1.01%	1.20%	.28	108	70	1010	9
Moses Lake, WA	2.52%	0.23%	0.57%	1.75%	.62	45	28	316	6
Moses Lake, WA	2.52%	0.31%	0.70%	1.46%	.62	41	36	260	6
Monroe, OR	2.71%	0.16%	0.75%	1.29%	.52	69	33	382	4
Ridgefield, WA	2.74%	0.34%	0.63%	1.65%	.43	109	51	220	10
Lebanon, OR	2.15%	0.20%	0.67%	1.19%	.37	126	33	144	7
Lebanon, OR	2.06%	0.17%	0.60%	1.22%	.40	137	28	137	7
Mossyrock, WA	2.27%	0.15%	0.95%	0.88%	.18	31	29	111	8
St. Paul, OR	2.17%	0.20%	0.56%	1.96%	.45	118	39	238	6
Hood River, OR	2.22%	0.59%	0.82%	4.22%	.65	83	138	789	6
Northport, WA	2.14%	0.34%	1.18%	0.68%	.32	300	55	144	7
Northport, WA	2.20%	0.37%	1.12%	0.58%	.27	250	56	238	7
Selah, WA	2.42%	0.32%	0.80%	1.29%	.45	368	133	232	10
Selah, WA	2.96%	0.23%	0.94%	1.81%	.37	353	127	199	8
Selah, WA	2.45%	0.36%	0.93%	1.60%	.40	280	116	275	8
Median	2.45%	0.23%	0.82%	1.29%	.30	109	51	238	7
Mean	2.44%	0.28%	0.83%	1.45%	.38	150	63	343	8
Min	2.06%	0.15%	0.56%	0.58%	.4	31	28	111	4
Max	2.96%	0.59%	1.18%	4.22%	.65	368	138	1010	10
Std. Deviation	0.27%	0.11%	0.19%	0.82%	.17	113	40	253	2

Willing to Help Newcomers?

Can we list you on the WCGA website as someone willing to help new or prospective growers? If so let your Editor/

Webmaster know at

Carolyn@ChestnutsOnLine.com

I am suggesting that we start with critical levels for hazelnuts and adapt them to serve the needs of chestnut growers. The other tree nut that we grow here in the Pacific Northwest is walnuts. The walnut tree is such an enormous tree at maturity that it takes large amounts of fertilizer per tree to satisfy its nutritional needs. The hazelnut tree is more like the chestnut tree in mature size, and the per tree density is often similar with the two crops. But,

they clearly have differences that we need to recognize. The levels for various nutrients and their status are listed in Table 2 below.

Leaf tissue analyses should be used to establish long term trends in orchard fertility management. This becomes especially important for mature orchards. The nutrient demand is greater for a larger tree, and if left unattended can result in yield and quality reduction.

Continued on p. 6

Continued from p. 5

Table 2. Fertility status levels for hazelnuts, suggested as a starting point for chestnut orchard leaf tissue analyses interpretation.

Nutrient	Defic.	Bel. Norm.	Normal	Above Norm.	Excess
NITROGEN	< 1.80	1.81 - 2.20	2.21 - 2.50	2.51 - 3.00	> 3.00
PHOSPHORUS	< 0.10	0.11 - 0.13	0.14 - 0.45	0.46 - 0.55	> 0.55
POTASSIUM	< 0.50	0.51 - 0.80	0.81 - 2.00	2.01 - 3.00	> 3.00
SULFUR	< 0.08	0.90 - 0.12	0.13 - 0.20	0.21 - 0.50	> 0.50
CALCIUM	< 0.60	0.61 - 1.00	1.01 - 2.50	2.51 - 3.00	> 3.00
MAGNESIUM	< 0.18	0.19 - 0.24	0.25 - 0.50	0.51 - 1.00	> 1.00
MANGANESE	< 20	21 - 25	26 - 650	651 - 1000	> 1000
IRON	< 40	41 - 50	51 - 400	401 - 500	> 500
COPPER	< 2	3 - 4	5 - 15	16 - 100	> 100
BORON	< 25	26 - 30	31 - 75	76 - 100	> 100
ZINC	< 10	11 - 15	16 - 60	61 - 100	> 200

When we attempt to interpret results from our leaf tissue and soil test results there are many helpful tips to remember. The most important thing to do is to compare the results with what you see in the orchard. Nitrogen values from a leaf test must be judged in light of the conditions in the orchard. A grower should check to see whether leaf color and shoot length looks good. If they look great, then adding more nitrogen in response to a slightly below normal leaf test should be done with caution. An adequate amount of total nitrogen for a tree can sometimes be “spread out” over a vigorous shoot growth. Then the leaf tissue reading can seem somewhat “diluted”, when in fact enough nitrogen is present for good growth and yields.

The potassium levels in our chestnut leaves were in the normal range, but on the low side of normal. One of the conditions that can cause low potassium readings is water stress in the trees. I see this in our dry land crops like hazelnuts, prunes and cherries. Drought years have lower than average potassium levels. Also, a large nut crop can draw leaf potassium levels lower than normal.

It could be that potassium applications may be helpful for our chestnut orchards. Remember that muriate of potash should be applied in a band in the winter, before February 15th in western Oregon. Application of muriate after that time is risky, in that a chloride burn may occur on the trees. We need the heavy winter rains to leach out the chloride salts before the trees begin to grow in the spring. If you have to apply potash after mid-February, then use potassium sulfate.

OSU researchers have not been able to find a significant response to phospho-

rus applications in Western Oregon orchards. In fact, the current OSU fertilizer guide states that Willamette Valley orchards do not respond to phosphorus applications. There have been very few successful experiments where significant responses to phosphorus fertilizers have been obtained. I remain open to the possibility, but I have always discouraged growers from wholesale phosphorous applications. I don't like seeing orchardists wasting money.

When we compare the median and mean levels of the chestnut samples taken in 2000 to the normal range of the hazelnut critical levels, nearly every nutrient falls into the normal range. The one exception is boron, where the chestnut averages were much higher than the hazelnut levels. Some of this is due to samples that came in from eastern Washington where the soil boron levels are much higher. Besides that, in hazelnuts we don't really use the leaf boron level to trigger applications. Rather, we use it to avoid toxic responses when the leaf levels approach 200 ppm.

Soil tests are a useful tool and can be taken at any time of the year. I think it is best to have the results in hand by the fall of the year, so that liming can be done after the harvest is complete. The usual depth of the soil sample is in the top six inches. Occasionally it is a good idea to take one below the one-foot level.

We recommend applying lime to most orchard crops when the soil pH is 5.6 or below, with chestnuts being an exception. We look to the SMP buffer test to determine the correct amount to apply. This buffer test indicates the soil type's capac-

ity for reaction to liming. The buffer readings with the amount of lime in tons per acre to apply listed in parentheses is as follows: 5.9 - 6.2 (1 to 2 tons/A), 5.6 - 5.9 (2 to 3 tons/A), 5.2 - 5.6 (3 to 4 tons/A), below 5.2 (4 to 5 tons/A). Since the recommended soil pH for chestnut orchards is between 5.0 and 6.0 we generally won't need to apply large amounts of lime. I have seen soils below 5.0 but it is rare. Growers on the eastern side of the Cascades may even need to use sulfur to lower their naturally high pH levels down to the ideal of 5.0-6.0.

The calcium reading on a soil test is listed in “milli-equivilants per 100 grams” of soil (meq/100 g). If your reading is below 5, you should consider a lime application of at least one ton per acre, even if the pH and buffer test don't indicate one is needed. Some people also like to consider the ratio of calcium to magnesium. The calcium reading should always be higher than the magnesium, unless something is way out of balance. I have never seen a test result in the Valley where the magnesium is higher than calcium. The magnesium is also listed in the same form as calcium. If the magnesium level drops below 0.5 meq/100 g, then you should use dolomitic lime instead of regular limestone. If you wanted to correct a magnesium deficiency in a chestnut orchard without liming you could apply epsom salts, which are high in magnesium.

One of the more useful purposes of a soil test is to give you a reading of the potassium level in the soil. Potassium is essential to productive hazelnut trees. If your test results read 0 to 75 parts per million (ppm) of potassium, you should apply 300-400 pounds per acre of actual potash (K 2 O). If the reading is 75-150 ppm, then add 200-300 pounds per acre. If your potassium reading is over 150 ppm, then no potash is needed. In a mature orchard, a leaf tissue test is needed to assess the need for potassium application, and the soil test is used to verify low K in the soil.

The process of evolving useful interpretations of chestnut leaf tissue analyses will involve grower participation, orchard observations and gleaning information from other parts of the world that grow chestnuts. The goal is to maximize the efficiency of fertilizer use in chestnuts so that good yields with good quality can be economically produced.



Acknowledgments

Thanks to Christopher Foster whose well timed misfortune allowed him to provide photographs for this article, and to Randy Coleman who took the time to provide observations and explain his approach to managing the disease. Caroline Boutard, a student at Cornell University, patiently collected papers for me, tolerating my cranky and imperious demands.

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ADDITIONS

We have received the following additions and/or modifications to membership since publication of the membership directory. You'll want to note these in your copy.

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Corrections

The following corrections were reported for the Membership Directory. You'll want to correct these in your copy:

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Harvey Correia:

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Hill Craddock:

Website is www.utc.edu/jcraddoc/
chestnutlinks.html

Greg Miller lives in Carrollton, OH, not Carrolton, OH

If you find other errors in your membership directory please let your editor know.

**Don't forget to
make your
reservation now for
the California
Orchard Tour
Sept. 7-8
See p. 5 for details**

FOLIAR ANALYSIS PROJECT – 2001 Mark Your Calendar

- Call OSU for your leaf sample kit in July. See WCGA website for more info:
<http://www.chestnutsonline.com/wcga>
- Collect your leaves in mid-August and send kit to OSU
- Send a copy of your results to Anthony Boutard for compiling. Results will be published in the newsletter and on the WCGA website.

LETTERS TO THE EDITOR

I just received my copy of The Western Chestnut 3(2), Spring 2001. Great job! I am particularly impressed with Anthony's rendering of "John Evylyn's Chestnut". Thank you,
Sincerely,
Hill Craddock

Did you hear the one ...

A group of chess enthusiasts checked into a hotel and were standing in the lobby discussing their recent tournament victories. After about an hour, the manager came out of the office and asked them to disperse. "But why?" they asked, as they moved off. "Because," he said, "I can't stand chess nuts boasting in an open foyer."

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