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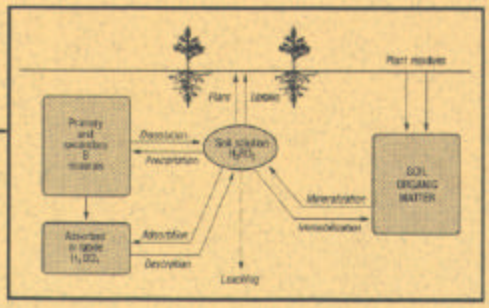
Forest Nursery Notes

Summer 2001

Cultural Perspectives
Micronutrients—Boron



Environmental Concerns
Nitrogen Fertilizer and Freaky Frogs

Integrated Pest Management
Biobeds for Pesticide Solution Disposal

Forest Nursery, Notes, Team

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Forest Nursery Notes
Summer 2001

Please Update Your Address: The FNN mailing list is always out-of-date so we would like to make sure that we have your latest address. Please take the time to check the mailing label and note any additions or corrections on the Literature Order Form at the back of this issue. In particular, check your telephone and FAX numbers because area codes keep changing. Supply the country code if you are a foreign subscriber. Also list your E-mail and website addresses if you have them.

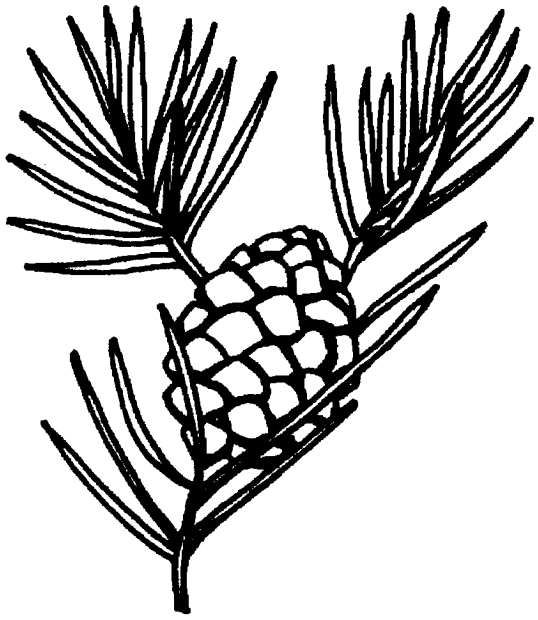
Technical Requests. Every day we receive letters, telephone calls, Faxes, and E-mail messages from around the world requesting publications or asking for technical assistance. Our technology transfer team prides itself on responding to all inquiries as soon as possible but we do have to set some priorities. Forest and conservation nurseries in the United States receive first priority and then we handle requests from foreign countries. Our contact information is listed on the inside cover of this issue. If Tom is not around, then contact David or Rae and we'll get back to you as soon as possible. You can make things easier if you will remember a few things when contacting us:

- Telephone calls are hard to understand sometimes, especially when the caller has an accent. If you leave a voice mail message, please speak slowly and give your full mailing address, phone, FAX, and E-mail numbers.

- FAX messages are easy to process but be sure to give your complete name, address, and return FAX number *including country code.*

- E-mail is the best option because it is non-invasive and accessible around the clock. If you are requesting publications, be sure and give us your full mailing address.

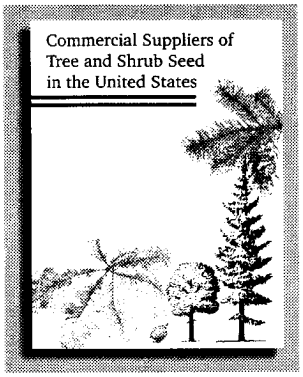
New E-mail and Website Addresses: Tom has a new "official" E-mail address (tdlandis@fs.fed.us), so please note it in your address book, and our website has also changed to: < http://www.na.fs.fed.us/spfo/mgr >



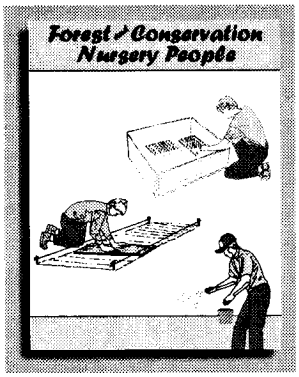
Nursery Networks

Directories on the Reforestation, Nurseries, and Genetic Resources (RNGR) home page - One of the objectives of Forest Nursery Notes is to promote networking and so we maintain several different directories on our website. ***Note the new address:***

< http://www.na.fs.fed.us/spfo/mgr >

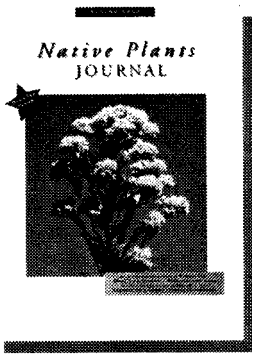


Commercial Suppliers of Tree and Shrub Seed in the United States - This directory provides a list of vendors of tree and shrub seed for the US. The directory starts with some basic information on seed quality and then is followed by addresses and telephone and fax numbers. Services supplied by each vendor is also included along with an alphabetical list of all the tree and shrub seed sold in the US and common plant names. Again, much of this information is already out-of-date so please let us know if there are changes or additions.



Forest and Conservation Nursery People - This is an MS Excel spreadsheet of people who work in the forest and conservation nursery field from around the world. It is composed of the mailing list for FNN so, if you'd like to be added to the directory or update your listing just fill out and return the Literature Order Form in the back of this issue.

Directory of Forest and Conservation Nurseries -This directory is organized by state and contains the latest addresses and production information for forest and conservation nurseries on a state-by-state basis. For those nurseries that have them, links to E-mail addresses and WWW home pages are also provided. Ownership category, type of nursery (container or bareroot), and current and potential seedling distribution are included. We are continuing to update this directory so contact us if your listing needs to be corrected.



Directory of Native Plant Nurseries - (<http://nativeplants.for.uidaho.edu>) We are working with the Lady Bird Johnson Wildflower Center in Austin, Texas on an on-line directory. Contact Kas Dumroese to make sure you are included: E-mail: dumroese@uidaho.edu > or TEL: 208.885.3509.

Nursery Meetings

This section lists upcoming meetings and conferences that would be of interest to nursery, reforestation, and restoration personnel. Please send us any additions or corrections as soon as possible and we will get them into the next issue.

The **Northeastern Nursery Conference** will be held the week of ***July 23 to 26, 2001*** at Toftrees Conference Center and Resort, State College, PA. Toftrees is adjacent to the Penn State University campus, home of the Nittany Lions, aka Joe's Place. The conference theme is Sustainable Nurseries-Sustainable Forests. Contact Alex Day for the agenda and registration information.

Penn Nursery
137 Penn Nursery Road
Spring Mills, PA 16875
TEL: 814.364.5150
FAX: 814.364.5152
E-mail: pennnursery@dcnr.state.pa.us

Western Forest and Conservation Nursery Association will be meeting at Ft. Lewis College in Durango, CO on ***July 30 to August 3, 2001***. The college has excellent meeting facilities and attendees can stay right on campus at the Anasazi Apartment complex for a very reasonable rate. As usual, the meeting will consist of technical sessions and field trips. This year we will visit the BIA Southern Ute Forest Nursery and Mesa Verde National Park. For more information, give me a call:

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2606 Old Stage Road
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FAX: 541.858.6110
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The Eighth Workshop on **Seedling Physiology and Growth Problems in Oak Plantings** will be held at the Lake Chatuga Lodge in Hiawassee, GA on ***September 9 to 12, 2001***. The meeting will consist of technical papers, discussion periods, and field trip to oaks outplanting sites. If you would like to present a paper or poster or just want more information, you can contact:

Linda Watson or Paul Kormanik
Institute of Tree Root Biology
USDA Forest Service
320 Green Street
Athens, GA 30602
TEL: 706.559.4288
FAX: 706.559.4291
E-mail: lwatson01@fs.fed.us

The 20th annual ***Nursery Pathology Workshop*** will be held in conjunction with the ***Western International Forest Disease Work Conference (WIFDWC)*** in Carmel, California on ***September 10 to 14, 2001***. The conference will held at the Carmel Mission Inn. Please access the WIFDWC website for more information:

< www.fs.fed.us/foresthealth/technology/wif >

To present a poster contact:
Mike McWilliams
Oregon Department of Forestry
TEL: 503.945.7395

For general information contact:
Diane Hildebrand
P.O. Box 3623
Portland, OR 97204
TEL: 503.808.2997

Energy Use, Future Seedling Production & Demand is the theme for the 21st annual meeting of the ***Forest Nursery Association of BC***. The meeting will be held ***September 24 to 26, 2001*** at the Best Western Vernon Lodge in Vernon, BC, Canada. For reservations call 250.545.3385. Please visit the website for more information:

< www.for.gov.bc.ca/nursery/fnabc/fnabc.htm
or contact:
Stewart Haywood-Farmer
TEL: 250.542.4100
E-mail: Shaywood-farmer@prtgroup.com

The DoubleTree-San Diego, Mission Valley Hotel in San Diego, California will be the site of the ***2001 International Research Conference on Methyl Bromide Alternatives & Emissions Reduction.*** The conference is sponsored by Methyl Bromide Alternatives Outreach (MBAO) and will feature concurrent sessions concerning research on alternatives to methyl bromide for preplant, post-harvest, and structural uses. The conference will take place on ***November 5 to 8, 2001***. Please visit the MBAO website for registration and general information: < www.mbao.org >

For information contact:
MBAO
144 W. Peace River Drive
Fresno, CA 93711-6953
TEL: 559.447.2127
E-mail: robenauf@agresearch.nu
Or
gobenauf@agresearch.nu

For Hotel Reservations contact:
The DoubleTree-San Diego, Mission Valley
7450 Hazard Center Drive
San Diego, CA 92108
TEL: 619.297.5466

Because the first meeting was so successful, a ***Second Native Plants: Propagating and Planting*** meeting is being planned for ***December 12 to 13, 2001*** in Eugene, OR. This conference is sponsored by the Oregon State University Nursery Technology Cooperative and the Western Forestry and Conservation Association. They are currently soliciting speakers for the conference so please send any ideas to Diane Haase as soon as possible. Contact Richard Zabel for general information on the meeting:

Diane Haase
Nursery Technology Cooperative
Oregon State University
Richardson Hall 301 C
Corvallis, OR 97331
TEL: 541. 737.6576
FAX: 541. 737.1393
E-mail: Diane. Haase@orst.edu
Website: www.fsl.orst.edu/coops/ntc/ntc.htm

Richard Zabel
Western Forestry and Conservation Assoc.
4033 SW Canyon Road
Portland, OR 97221
TEL: 503.226.4562
FAX: 503.226.2515
E-mail: richard@westernforestry.org

International Plant Propagators' Society (IPPS) meetings always cover a wide range of basic plant propagation concepts, techniques, and technologies, and are an excellent opportunity to expand your horticultural horizons. Currently, the Society has eight regions and one potential region. The IPPS home page (< http://www.ipps.org/ >) contains a wealth of information on these meetings and how to join the organization. I heartily recommend it!

IPPS Region	Date	Location
Eastern Region, North America	Sept. 30 - Oct. 3	Lexington, KY
Region of Great Britain & Ireland	Aug. 28 - 31	E. Midlands & E. Anglia
IPPS Japan	Autumn	Shizuoka
New Zealand Region	May I 1-13	Hamilton
IPPS Scandinavia	Early Sept.	To Be Determined
Southern Region, North America	Oct. 18 - 21	Houston, TX
Western Region, (USA and Canada)	September	Seattle, WA
Southern African Potential Region	March	To Be Determined

The International Union of Forest Research Organizations is planning to hold the **Fifth Meeting of the IUFRO Working Party S7.03.04 (Diseases and Insects in Forest Nurseries)** in the State of Kerala, India during late 2001 or the first half of 2002. For questions and information please contact:

Stephen Fraedrich
USDA Forest Service
320 Green St.
Athens, GA 30602
E-mail: sfraedrich@fs.fed.us

Dr. C. Mohanan
Division of Forest Pathology
Kerala Forest Research Institute
Peechi 680 653 Thrissur
Kerala, India

The **Southern Forest Nursery Association** will meet in Gainesville, FL in the ***July 15 to 18, 2002*** at the University of Florida Hotel & Conference Center. Detailed information regarding registration and the meeting agenda will be forthcoming in the fall of 2001. Please contact Steve Gilly if you are not on the association mailing list and would like the latest information. The forest nurseries in Florida are looking forward to hosting an exciting and informative meeting.

Steve Gilly
Florida Division of Forestry
Andrews Nursery
P.O. Drawer 849
Chiefland, FL 32644-0849
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Health and Safety

The Trouble With Ticks

The Story
Ticks sometimes transmit Lyme Disease, a potentially debilitating disease. People who work or recreate outdoors could be infected when the disease is present and they don't take a few simple proper protective measures. Supervisors must make sure that their field-going employees understand the nature of the hazard, and that they protect themselves.

Lyme disease was first recognized in 1975 after researchers investigated why unusually large numbers of children were being diagnosed with juvenile rheumatoid arthritis in Lyme, Connecticut and neighboring towns. It was discovered that most of the affected children lived near wooded areas that harbored ticks.

Lyme disease is an infection caused by a bacterium *(Borrelia burgdorferi)* that is carried in the east and Midwest by the deer tick, and in the west by the Western black-legged tick. In early stages the disease causes a skin rash, and sometimes joint pain, chills, fever and fatigue. As it progresses, it affects joints and the nervous system. During early stages of infection, Lyme disease can be successfully treated with antibiotics. If *untreated during the early stages, Lyme disease can cause serious and sometimes disabling disorders.*

Life Cycle of a Tick
After it hatches from the egg, a tick undergoes several growth stages during a two year period:

1 . Eggs laid in spring hatch in the summer.
2. Larvae (the size of a newsprint period) lie on the ground, waiting for a host to brush against them.
3. After a blood meal, the larvae drop off and molt into nymphs during the fall.
4. Nymphs (the size of a poppy seed) become active the next spring and attach themselves to another host. After a blood meal, they drop into the leaf litter and molt into adults.
5. Adults (the size of a sesame seed) climb onto edges of grass or leaf tips in the fall, and wait for their next host. After feeding for about a week, adults mate.
6. Adults that don't get their blood meal by the time cold weather arrives go into a dormant stage during the winter. When temperatures get above 40 degrees F, they again look for a host.
7. In the spring, females lay approximately 3,000 eggs under the leaf litter.

The eggs hatch in the summer and the cycle continues...

Transmission of Lyme Disease:

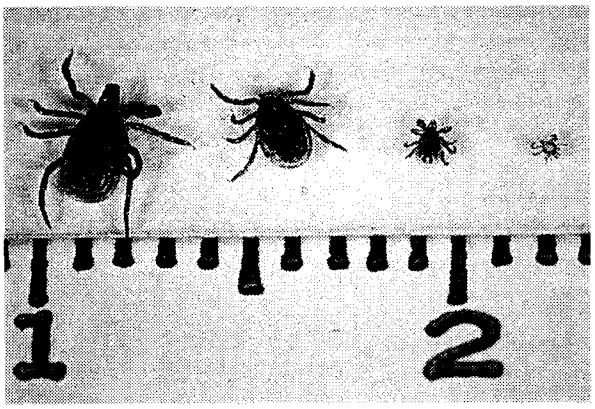


Figure 1: From left to right: The deer tick (Ixodes scapularis) adult female, adult male, nymph, and larva on a centimeter scale. (Center for Disease Control)

Tick larvae are not infected when they are born, and will not transmit the disease. Larvae and nymphs become infected when they feed on an infected host. Nymphs and adults can infect hosts if the larva or nymph became infected during its previous life stage. Studies indicate that if an infected nymph feeds on some species of lizard, the bacteria are killed, and the tick will not transmit the disease when it is in the adult stage.

Tick Food and Habitat Preferences:
Larvae and nymphs prefer small mammals, birds, and lizards, but are will feed on larger animals, including humans. Adults prefer to feed on deer, but are willing to substitute other larger mammals, including humans. Nymphs live in leaf mold and on the ground. Nymphs wait on the ground or on the edges of grass leaves. Adults wait on grass or leaves of other vegetation within 3 feet of the ground. When a host brushes by, the tick climbs on the host and looks for a place to attach itself. Once it attaches itself to the host the tick will feed for several days to a week. After it is engorged, it drops off. Larvae and nymphs then wait for the next life stage before they feed again. Adult females develop and lay their eggs, and die.

At-risk Occupations and Employer Responsibilities:
Any occupation that requires outdoor work in an area where Lyme disease is endemic is considered at risk of becoming infected. Employees working in wildland environments may be exposed to ticks carrying Lyme disease. These employees must understand the nature of Lyme disease, how they might be infected, and how they can protect themselves. Employers must provide means for employees to protect themselves, and to get medical attention if exposed to the disease.

Preventing infection

To prevent exposure to infection, people whose work requires them to be in forested, brushy, or grassy areas should do the following to protect themselves from being bitten by ticks:

- Assume that ticks which are infested with *Borrelia burgdorferi* may be present.
- Dress in a manner that prevents ticks from getting on their skin, and that allows them to easily see ticks on the clothing (i. *e.* light-colored clothing).
- Watch throughout the day for ticks on their clothing and skin, and remove them immediately.
- Avoid placing jackets and other clothing on the ground.
- Check for presence of ticks on their body at the enc of the day, and carefully remove them if they occur. (Note: Studies indicate that ticks normally infect a host only after they have been feeding for 36 to 48 hours.)

Protective measures

- Wear boots, light-colored pants, and light-colored long-sleeved shirts. Tuck pants into socks and shirts into pants.
- Keep long hair gathered up or tied back, and covered.
- Use insect repellant containing DEET on exposed skin. (Follow *manufacturer's directions.)*
- Apply DEET or Permethrin (an insecticide) on clothing. (Follow *manufacturer's directions. Do not use Permethrin on skin.)*

Removing a tick Do:

- Use a specially designed tick removal tool, or fine pointed precision tweezers.
- Grasp the head or mouth. Gently and firmly pull outward.
- Clean the bite wound with disinfectant.
- Get medical assistance to remove ticks if they are difficult to access, if you do not have the proper tool, or if you are not confident you can do it properly.
- Save the tick to assist in diagnosis if problems develop.

Do not:

- Grasp the tick by the body.
- Twist the tick.
- Apply oil, petroleum jelly, alcohol, heat, or other irritants.
- Try removing ticks without proper tools.
- Try to remove ticks that are difficult for you to see or reach.

Symptoms

The most common early symptom of Lyme disease is an expanding rash. A rash occurs in 80 to 90% of infections. The rash is solid red or a series of red rings (Figure 2). It expands to a diameter ranging from 2 to 24 inches. On dark-skinned people, the rash may look like a dark bruise. The rash appears 3 to 30 days after infection occurs, and lasts for 3 to 5 weeks. The rash is usually not painful or itchy. Other symptoms which may occur around the time the rash occurs are: swelling of lymph glands, headache, joint pains, chills, fever, and fatigue. Sometimes these symptoms may be intermittent and mild. Severe, potentially debilitating symptoms can occur weeks, months, or even years after being bitten by an infected tick. Such symptoms include, severe headaches, painful arthritis, cardiac abnormalities and cognitive (mental) disorders.

Figure 2 A circular rash is symptomatic of Lyme disease. **Photo courtesy American Lyme Disease Foundation, Inc.**

Treatment

Lyme disease is easily treated with antibiotics, and almost always cured when it is treated during the early stages of infection. Treatment within the first 3 weeks of infection is straightforward and almost always successful. The cure rate decreases the longer treatment is delayed. Generally, Lyme disease can be effectively treated in its later stages, but symptoms may linger for

months or years following treatment. In rare instances, Lyme disease causes permanent damage. Get medical assistance in removing ticks that are not easy to access, or those that have attached themselves long enough to engorge and enlarge. See a physician immediately if an expanding rash occurs near a tick bite; or if joint pain, chills, fever or fatigue occur after incurring a tick bite. Diagnosis can be complicated so choose a physician who understands current methods of diagnosing and treating Lyme disease.

Lyme disease vaccine

Employees should consult with their physician to determine if the vaccine is appropriate for them, and whether they want to request the vaccination series. The vaccine is given in a series of 3 shots, starting with the initial visit. The second shot occurs at 1 month, and the third at 6 to 12 months after the initial shot. Studies indicate that the vaccine is 80% effective after all 3 shots, and 50% effective after 2 shots. Although data are not yet conclusive, it is anticipated that boosters in subsequent years will be needed on an annual basis. Undesirable side effects of the vaccine may occur. The vaccine may not be effective in providing immunity for all strains of Lyme disease and is not effective in providing immunity for other major diseases which ticks may carry

Conclusions and Recommendations

Employees working outdoors may be exposed to ticks that could transmit Lyme disease and other diseases. These employees should:

- Dress in a manner that prevents ticks from attaching to their skin and allows the employee to easily see ticks on their clothing.
- Check their bodies for presence of ticks at the end of the day.
- Know how to recognize and remove ticks and understand symptoms of infection.
- Report all tick bites to their supervisor.
- Get medical treatment if they have difficulty removing a tick; if the tick is damaged or squeezed during removal, or, if they experience symptoms of Lyme disease infection.
- Understand that a Lyme disease vaccination is available to them but vaccination is not a substitute for preventing exposure to tick bites.

Additional information about Lyme disease is available on the internet from organizations such as the American Lyme Disease Foundation, Inc. <www.aldf.com> and The Lyme Disease Network of NJ, Inc. <www.lymenet.org/>. Information is also available from The Centers For Disease Control, The Occupational Safety and Health Administration, and local public health agencies.

Sources:

Reim, J.; Hollars D., 2001. The Trouble with Ticks

Cultural Perspectives

Micronutrients - Boron

Boron (B) is the fifth of the micronutrients that we have discussed in this series (Table 1). Boron is unusual because it is the only trace element that is not a metal. It is not found free in nature because, like carbon, it has the capacity to form stable covalent bonds. Boron occurs in very low concentrations in most soil parent materials but is the micronutrient that most commonly limits yields of agricultural crops. Deficiencies have occurred in over 132 crops around the world, including forest trees grown in plantations. Boron is also unique because it first received attention due to its toxic effects. Because boron is often carried in irrigation water, toxicities are relatively common in arid and semiarid regions.

Table 1 - The seven essential micronutrients and their typical concentrations in seedling tissue

Element	Symbol	Average Concentration in Plant Tissue (%)	Adequate Range in Seedling Tissue (ppm)		Where and When Published
			Bareroot	Container	
Iron	Fe	0.01	50 to 100	40 to 200	Forest Nursery Notes: July, 1997
Manganese	Mn	0.005	100 to 5,000	100 to 250	Forest Nursery Notes: January, 1998
Zinc	Zn	0.002	10 to 125	30 to 150	Forest Nursery Notes: July, 1998
Copper	Cu	0.0006	4 to 12	4 to 20	Tree Planters' Notes: 49 (3)
Molybdenum	Mo	0.00001	0.05 to 0.25	0.25 to 5.00	To Do: Winter, 2002
Boron	**B**	**0.002**	**10 to 100**	**20 to 100**	**This issue**
Chloride	Cl	0.01	10 to 3,000	NA	To Do: Summer, 2002

Role in Plant Nutrition

More research has been done on boron nutrition than on any other micronutrient. Early trials showed significant growth-promoting effects when boron was supplied in low concentrations but severe toxicity when present in higher amounts. To further complicate matters, the range between deficient and toxic levels of boron is very narrow.

Although boron is not a structural component of plant tissues, it is essential for numerous metabolic reactions. Boron is involved in cell division and elongation; lignification of cell walls; translocation of nitrogen, phosphorus, sugars, and starches; synthesis of amino acids and proteins; and carbohydrate metabolism. Pollination and fruit set is affected as well as nodule formation in legumes. One of boron's most critical functions involves the development and growth of new cells and therefore one of the first visual symptoms of boron deficiency is cessation of meristem activity, followed by death of new leaves. Boron deficiency also reduces the stability of cell membranes, causing them to leak amino acids and sugars. This effect, and the fact that boron helps produce phenolic compounds toxic to fungal parasites, explain why deficiencies weaken the plant's physical and chemical defenses.

Availability and Uptake

Boron typically exists in four major locations in soil and is readily cycled between both organic matter and soil minerals (Figure 1). In the soil solution, orthoboric acid (H_3BO_3) behaves much like an anion and therefore boron is not tightly held to soil particles. This causes it

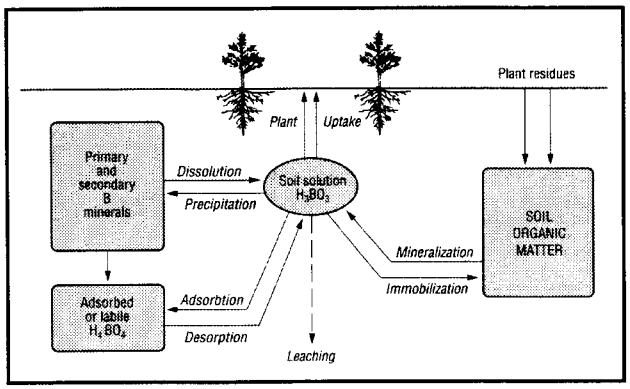


Figure 1

to be readily leached under high rainfall or irrigation conditions, similar to other anions such as phosphate and nitrate. Course textured soils that are low in organic matter content are even more vulnerable because they possess fewer exchange sites for boron retention. In addition, boron availability decreases with increasing pH, particularly on calcareous and clay soils. Young plants with small root systems, and species that have shallow root systems are most likely to suffer unless there is constant replacement. Deficiency can also occur under drought conditions because mass flow of water to plant root systems is impaired. Boron, like calcium, is immobile once it is assimilated and so cannot be translocated from older tissues to seedling meristems. Thus, new tissue growth is dependent on a continuous supply of boron from the soil or growing media. Passive uptake of boron relies on mass flow of soil solution to newly formed root tips, which have the greatest absorptive capacity. After uptake, xylem water flow delivers boron throughout the plant. Because root pressure is a relatively minor factor, the ability of a tissue to obtain boron is mainly a function of its transpiration demand. Unfortunately, meristems, buds and fruit, which are the very tissues that need boron the most, often loose out to young leaves, which transpire water at the highest rates. Non-transpiring organs must rely on root pressure, which is relatively weak and sometimes only available at night. High transpiration rates (very dry conditions) may carry boron to places where it is less needed while low transpiration rates (high humidity) reduce boron uptake in general. Thus, minimizing plant moisture stress is critically important to prevent boron deficiency.

Diagnosis of Deficiencies and Toxicities

Deficiency symptoms - Visible boron deficiency symptoms manifest themselves at the growing points. Below ground, root elongation is reduced and will cease altogether within 24 hours of complete boron removal. Above ground, terminal buds and young leaves become distorted and/or discolored and may die. Internodes are generally shorter, giving seedlings a bushy or rosette appearance (Figure 2A). At low foliar concentrations, conifer seedlings will appear stunted with terminal buds small or absent (Figure 2B). Dropping buds, flowers and immature fruit is also a typical symptom of boron

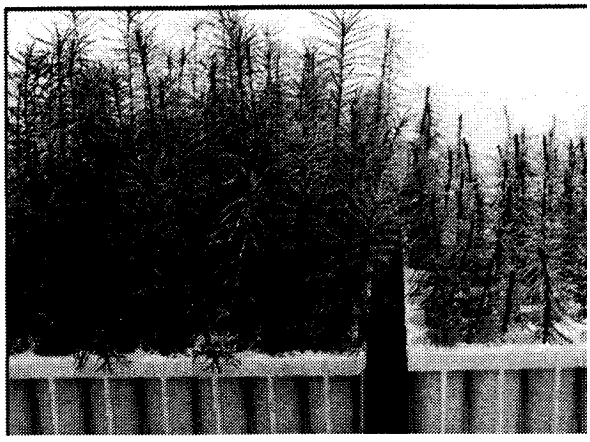


Figure 2A

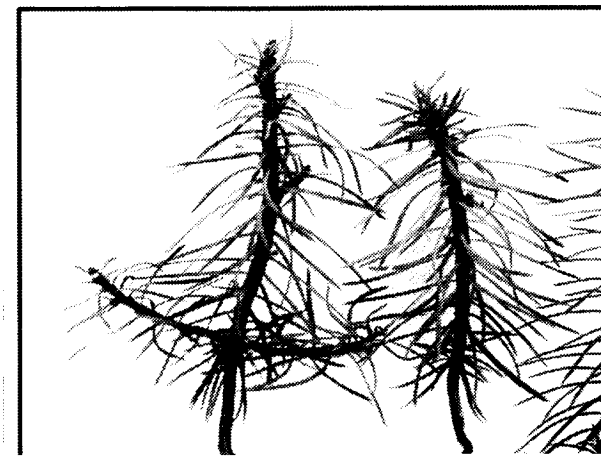


Figure 2B

deficiency. Often subsequent infections by disease causing organisms are inevitable, and can also lead to misdiagnosis of the real problem.

Sufficient boron levels vary with plant species, life stage, and climate. The main differences in boron requirements are thought to be related to differences in cell wall composition. Species with greatest lignification tend to have the highest requirement for boron. For this reason boron deficiency in monocots is less common than dicots and can be especially severe in woody plants. Sensitivity to low boron levels is increased under bright weather conditions. This is thought to be due to its involvement in phenol synthesis, a group of compounds that are elevated in plants growing under high light intensity.

Toxicity symptoms - Boron toxicity symptoms include chlorosis and necrosis of the terminal bud and on margins or tips of mature leaves. Stunting is also common although not symptomatic. Whereas toxicity is rare under natural conditions, it is increasing being encountered on sites that have been treated with boron-containing wastes, such as domestic laundry wastewater, sewage effluent, fly ash from coal, fiber glass insulation, tunnel or mine spoils. Misapplication of boron fertilizers through inconsistent fertilizer distribution and soil incorporation. Boron is commonly carried in water and toxicity can occur when using irrigation water with concentrations as low as 0.5 to 1.0 ppm.

Monitoring

The boron status of nursery soils or growing media can be monitored with seedling nutrient analysis and tests of irrigation water. Soil testing is of dubious value in determining boron availability because it is physically or chemically immobilized in most soils (Figure 1). Nevertheless, soil tests can reveal areas where boron deficiency will *not* occur. Analysis of seedling tissue has resulted in an ideal range of 10 to 100 ppm boron (Table 1). The considerable variation between individual samples makes diagnosis of boron deficiency or toxicity difficult but foliar analysis can at least indicate the potential of boron deficiency. In actual practice, however, the occurrence of symptoms (Figure 2A and 2B) and the prompt correction with boron fertilizers has proven more useful in determining a boron deficiency problem than chemical analysis. Because boron toxicity is often related to water deposition, irrigation water analysis can be diagnostic.

Boron Management

As with all the micronutrients, soil management and fertilization are the two main ways to manage boron in forest and conservation nurseries.

Soil Management - Good soil management practices can play a role in avoiding deficiency and toxicity problems. Since boron retention is greatest in soils high in organic matter, maintaining adequate soil organic matter levels can reduce the likelihood of boron deficiencies. Soils high in calcium will restrict boron availability. Therefore crops growing on recently limed soils have a higher probability of showing boron deficiencies. The reverse of this is also true - high concentrations of calcium can protect crops from boron toxicity. Low soil water can depress boron uptake and mobility in the plant. Maintaining adequate plant moisture and reducing vapor pressure during the growing season will further reduce the chances of boron deficiencies.

Although high pH is frequently mentioned as an important factor is determining boron availability, overliming is the only situation that has practical significance. It appears the reason that excess lime causes problems is that aluminum hydroxide immobilizes boron rather than a simple high pH reaction. Therefore, care in applying lime is warranted to avoid boron deficiency.

Boron toxicity should not be a problem if all soil amendments are tested before use.

Fertilization - Boron is one of the most widely applied micronutrients. Boron deficiency is entirely preventable through the use of soil and foliar products coupled with good soil management practices. Boron fertilizers can be separated into those that are an immediate source of boron *(e.g.* Solubor®) and those that are longer acting *(e.g.* colemanite) (Table 2). Use completely soluble materials that can be applied as a foliar spray or banded in the soil for a quick response to boron deficiency symptoms. Foliar sprays have proven safe and effective on a variety of plants. Longer acting boron fertilizers are incorporated into the soil and attention to achieving even distribution is critical in avoiding patterns of boron toxicity and deficiency. Blending boron with large volume fertilizers such as superphoshate or ammonium nitrate is recommended to avoid distribution problems.

Table 2 - Some common fertilizers containing boron (B)

	Chemical Notation	B (%)	Use in **Nurseries**
Single Nutrient Fertilizers			
Boric acid	H_3BO_4	17	Foliar or soil applications
Borax	$Na_2B_4O_7 \cdot 10\ H_2O$	11	Soil applications
Solubar®	$Na_2B_4O_7 \cdot 5\ H_2O$+ $Na2B_{10}O16 \cdot 10\ H_2O$	20	Foliar or soil applications
Sodium tetraborate - Dehydbor	$Na_2B_4O_7$	22	Foliar or soil applications
Colemanite	$Ca_2B_6O_{11} \cdot 5\ H_2O$	10 to 16	Soil applications
Multinutrient Fertilizers			
Soluble Trace Element Mix-STEM®	B as Boric acid	1.4	Foliar or soil applications
Micromax®	B as Sodium borate	0.1	Incorporation in growing media
B frits	B as Boric acid	0.03 to 1.50	Only for soil applications
Plant-Prod® Chelated Micronutrient Mix	B as Boric acid	1.3	Foliar or soil applications
Compound 111®	B as Boric acid	0.2	Incorporation in growing media
Osmocote Plus®	B as Boric acid	0.02	Incorporation in growing media

Conclusions and Recommendations

In conclusion, boron is critical for the formation of new cells at growing points of root tips, ends of stems and flower buds. Deficiencies in forest and conservation nurseries can be prevented through soil and fertility management, which includes the use of boron fertilizers, maintaining soil organic matter levels and attention to soil moisture during growing season. Overliming should also be avoided. Toxicities can be avoided by correctly applying boron fertilizers and avoiding the use of any soil amendments containing elevated levels of boron.

Acknowledgment - Eric van Steenis of the British Columbia Ministry of Forests assisted with the writing of this article and his help is gratefully acknowledged.

Sources

Bell, R. W. 1997. Diagnosis and prediction of boron deficiency for plant production. Plant and Soil 193 (12): 149-168.

Bradford, G.R. 1965. Boron. IN: Chapman, H.D. ed. Diagnostic criteria for plants and soils. Riverside, CA: Homer D. Chapman: 33-61.

Havlin, J.L.; Beaton, J.D.; Tisdale, S.L.; Werner, L.N. 1999. Soil fertility and fertilizers. New Jersey: Prentice-Hall, Inc. 499 p.

Marshner, H. 1986. Mineral nutrition of higher plants. New York: Academic Press. 674 p.

Shorrocks, V.M. 1997. The occurrence and correction of boron deficiency. Plant and Soil 193 (1-2): 121-148.

Stone, E.L. 1982. Boron deficiency in a Southern pine nursery. Southern Journal of Applied Forestry 6 (2): 108-112.

Stone, E.L. 1990. Boron deficiency and excess in forest trees: A review. Forest Ecology and Management 37: 49-75.

Van den Driessche, R. 1989. Nutrient deficiency symptoms in container-grown Douglas-fir and white spruce seedlings. FRDA Report 100. Victoria, BC: B.C. Ministry of Forests. 29 p.

Integrated Pest Management

Biobeds for Pesticide Solution Disposal

Disposing of pesticides is always a problem at nurseries. Filling and rinsing spray equipment results in a large quantity of pesticide solution that must be contained and treated. No matter how much care is taken, there are still instances when pesticides are spilled, leaked or washed off the equipment, possibly contaminating surface or ground water. Pesticides can persist in the soil for long periods of time and, because filling and rinsing sprayers is usually done at the same location, these sites soon become potential hazards.

Agrochemical collection facilities have been proposed to prevent the potential soil and groundwater contamination associated with improper handling of pesticides. However, because they can cost from $8,500 to $40,000, these facilities would be cost prohibitive to many small nurseries. Besides, engineered facilities merely collect and contain pesticide solutions which will have to pumped and transported for disposal at a treatment facility.

Biobeds can be a simple and affordable solution to this problem. Originally developed in Sweden, these innovative structures have been shown to be very effective in collecting, retaining, and degrading pesticides. Biobeds are in-ground collection and treatment pits that contain pesticide solutions and break them down through microbiological activity. In their simplest design, a rectangular trench is excavated and filled with layers of topsoil and readily available organic amendments such as peat and straw (Figure IA). The trench contains vertical columns to support tractors and other pesticide application equipment so that pesticide solutions can be directly drained into the biobed (Figure 1 B). Biobeds have been traditionally lined with a clay seal to prevent leakage but a plastic liner would work even better. A cap of grass is grown on the surface of the bed to remove moisture and prevent surface erosion.

The beauty of the biobed concept is that organic layers hold pesticide solutions and prevent leaching while they are microbially degraded. The topsoil layer should be rich in humus and low in clay to encourage pesticide-degrading microorganisms and provide binding capacity. Peat provides additional binding capacity and retains moisture. The straw layer is the primary site where most of the degradation of pesticides takes place because it is a substrate for microorganisms which breakdown a broad spectrum of chemicals.

The US Environmental Protection Agency recently contracted to have the biobed concept scientifically evaluated. The results have not been formally published but the initial results show that the chemical half-life of pesticides can be significantly reduced with biobeds. Despite the fact that high concentrations (1,000 ppm) were initially applied, four agricultural herbicides were rapidly degraded (Table 1). The microbes in the corn wastes used in this trial were apparently very effective in degrading atrazine, which is known to be particularly persistent in ordinary field soil. These results suggest that biobeds could be custom designed to treat specific pesticides by selecting different organic amendments. Another exciting possibility is that modified biobeds could be used to treat pesticide-contaminated soils.

The biobed concept is still relatively new but it has definite application to forest and conservation nurseries. We're not aware of any nurseries currently using this technology but hopefully it will be operationally tested in the near future.

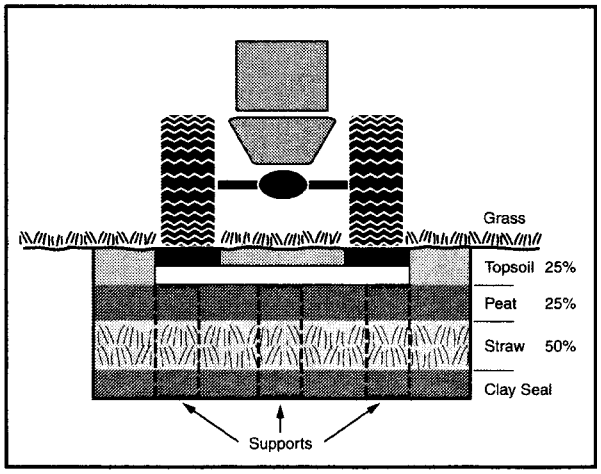


Figure 1 A

Figure 1B

Table 1:Degradation of pesticides within a biobed containing a mixture of 25% topsoil and 25% peat moss plus organic amendments

	Atrazine	Acetochlor	Alachlor	Metolachlor
	Chemical half-life days			
50 % Barley straw	2.2	5.5	27.3	29.6
50% Corn stovers	____	4.8	14.9	____
50% Corn cobs	0.62	____	____	27.8
Control (Field soils)	15 to 265	5 to 8	4 to 77	9 to 71

Source: Lamar (2001)

Sources:

Lamar, R.T. 2001. Final Report: Biobeds for containment and destruction of pesticides at agricultural mixing and loading facilities. Earthfax Development Corporation, U.S. Environmental Protection Agency Grant #68D00236. <URL:http://es.epa.gov/ncer/final/sbir/00/pollution/lamar.html> U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Research, Science to Achieve Results (STAR) Program.

Torstensson, L.; de Pilar Castillo, M. 1997. Use of biobeds in Sweden to minimize environmental spillages from agricultural spraying equipment. Pesticide Outlook (June 1997): 24-27.

Environmental Concerns

Nitrogen Fertilizers and Freaky Frogs

I'm sure that most of you are aware that water pollution by agricultural chemicals is a very hot news topic. The general public is convinced that their drinking water is polluted with chemicals, which explains the increasing use of bottled water.

The Press - A recent Associated Press newspaper article was entitled: "Declared OK for People, Fertilizer in Water can Kill Frogs, Study Finds." The accompanying photograph certainly caught your attention (Figure 1), as did the quote by a college professor: "Are You Comfortable Drinking Water with Levels of Fertilizer that Kills Off Frogs?" If you were having your morning oatmeal while reading this, you might have thought twice about swallowing.

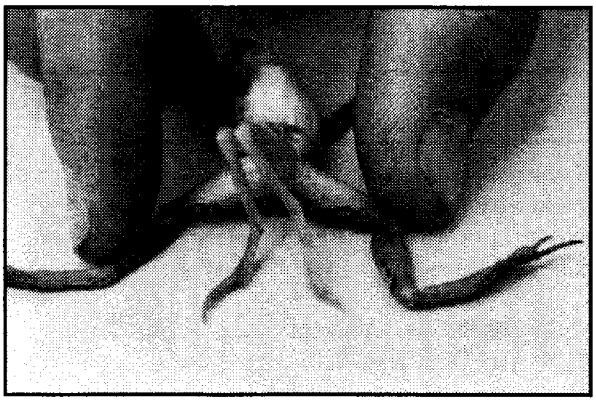


Figure 1

Reading further, the article quotes a research paper entitled "Sensitivity to nitrate and nitrite in pond-breeding amphibians from the Pacific Northwest, USA". The researchers studied 5 species of amphibians including the spotted frog *(Rana pretiosa),* the red-legged frog *(R. aurora),* the western toad (*Bufo boreas),* a tree frog *(Hyla regilla),* and the northwestern salamander *(Ambystoma gracile).* At low levels of nitrates, they found that two of the amphibians experienced increased rates of mortality (Figure 2). Extrapolating these controlled laboratory experiments to riparian systems, the authors suggested "that nitrogen-based chemical fertilizers are a possible cause of the decline of *Rana pretiosa* species in the lowland valleys (of western Oregon and Washington)".

Ecologists began noticing a global decline in amphibian populations in the mid 1980's and the freaky frog phenomenon (how's that for alliteration?) has even been adopted as a science project in some Minnesota schools. There is even a website showing Photos of Deformed Frogs: <http://www.pca.state.mn.us/hot/frogphotos.html>

Human Health Concerns - Should we be concerned about drinking water "with levels of fertilizer that kills off frogs?" The answer, according to a team of government scientists commissioned by the National Academy of Science, is not to worry. Reviewing the scientific literature, they found that current water quality standards (Table 1) "are adequate to protect human

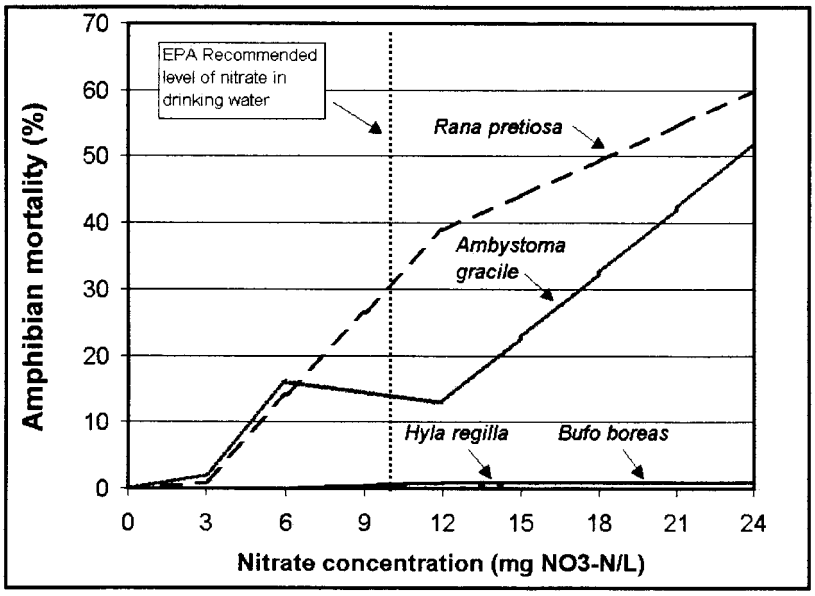


Figure 2

health" and that, at these levels, there is no supporting data to associate nitrate and nitrite exposure from drinking water to human ailments. In fact, nitrate is a normal component of our diet. The typical adult daily intake of nitrate in the US is 75 milligrams (mg) and 85% of that comes from natural nitrates in vegetables. Because of these naturally high levels, the daily intake by vegetarians can exceed 250 mg/day.

Table 1-National Drinking Water Standards As Directed by the Safe Drinking Water Act

Chemical	Symbol	Concentration (mg/l)
Nitrate	NO_3	44
Nitrate-nitrogen	NO_3-N	10
Nitrite	NO_2	3.3
Nitrite-nitrogen	NO_2-N	1
*milligrams per liter = parts per million		

Back to the freaky frogs - are all frog deformities caused by environmental pollutants? The journal Science published a recent article concluding that some frog deformities might have less to do with pollutants than to a microscopic flatworm called *Bieroria trematodes.* This natural parasite burrows into the hindquarters of frogs at the tadpole stage, rearranging the limb buds and interfering with limb development.

Conclusions and Recommendations - The general public is not going to read the follow-up articles or dig through the scientific reports that exonerate fertilizers because they are convinced that there is a problem. Therefore, we must continue to find ways to reduce the amount of fertilizers and pesticides that we use in our greenhouses and on our fields. We must also find ways to clean up water before it leaves the nursery and enters any waterway. Whether the press reports these issues in a responsible manner or not, we must not lose sight of our responsibilities to the environment through the use of good, applied science in our daily management activities.

Sources:

Marco, A.; Quilchano, C.; Blaustein, A. 1999. Sensitivity to nitrate and nitrite in pond-breeding amphibians from the Pacific Northwest, USA. Environmental Toxicology and Chemistry 18 (12): 2836-2839

Marco, A.; Blaustein, A. 1999. The effects of nitrite on behavior and metamorphosis in Cascades Frogs (Rana Cascadae). Environmental Toxicology and Chemistry 18 (5): 946-949.

Sessions, S. K. 1998. Frog Deformities. Science 279: 459

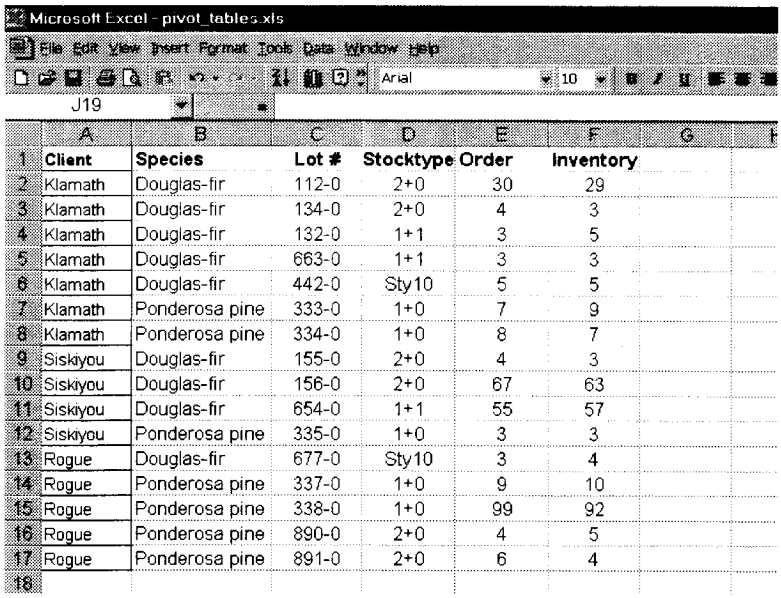
Wogan, G.N.; Generoso, W.; Koller, L.D.; Smith, R.P.; Tannebaum, S.R. 1995. Nitrate and nitrite in drinking water. National Academy Press, Washington D.C. 63 p.

Using the Pivot Table to Summarize Spreadsheet Data

Are you looking for a quick way of summarizing data? Figure 1 shows a typical seedling inventory dataset that is generated at most nurseries. For large nurseries, this dataset can be hundreds of lines long. Summarizing large seedling orders by client, species or stock type could take hours. We recently discovered a tool called Pivot Tables in the Microsoft* Excel Spreadsheet program that will summarize spreadsheet data of any size and complexity in a matter of minutes.

We will demonstrate how the pivot table works on the following nursery inventory spreadsheet (Figure 1):

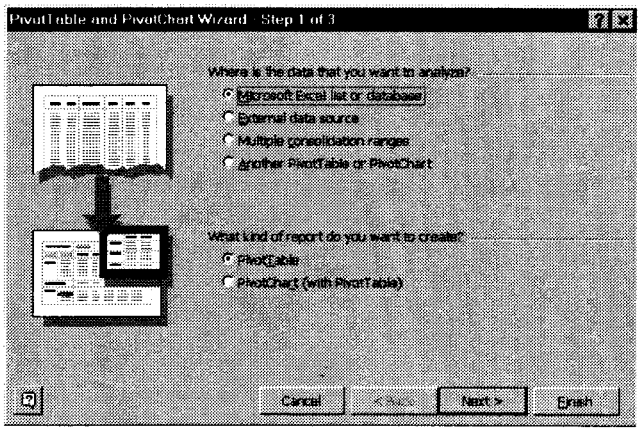
Figure 1



	A	B	C	D	E	F	G
1	**Client**	**Species**	**Lot #**	**Stocktype**	**Order**	**Inventory**	
2	Klamath	Douglas-fir	112-0	2+0	30	29	
3	Klamath	Douglas-fir	134-0	2+0	4	3	
4	Klamath	Douglas-fir	132-0	1+1	3	5	
5	Klamath	Douglas-fir	663-0	1+1	3	3	
6	Klamath	Douglas-fir	442-0	Sty10	5	5	
7	Klamath	Ponderosa pine	333-0	1+0	7	9	
8	Klamath	Ponderosa pine	334-0	1+0	8	7	
9	Siskiyou	Douglas-fir	155-0	2+0	4	3	
10	Siskiyou	Douglas-fir	156-0	2+0	67	63	
11	Siskiyou	Douglas-fir	654-0	1+1	55	57	
12	Siskiyou	Ponderosa pine	335-0	1+0	3	3	
13	Rogue	Douglas-fir	677-0	Sty10	3	4	
14	Rogue	Ponderosa pine	337-0	1+0	9	10	
15	Rogue	Ponderosa pine	338-0	1+0	99	92	
16	Rogue	Ponderosa pine	890-0	2+0	4	5	
17	Rogue	Ponderosa pine	891-0	2+0	6	4	
18							

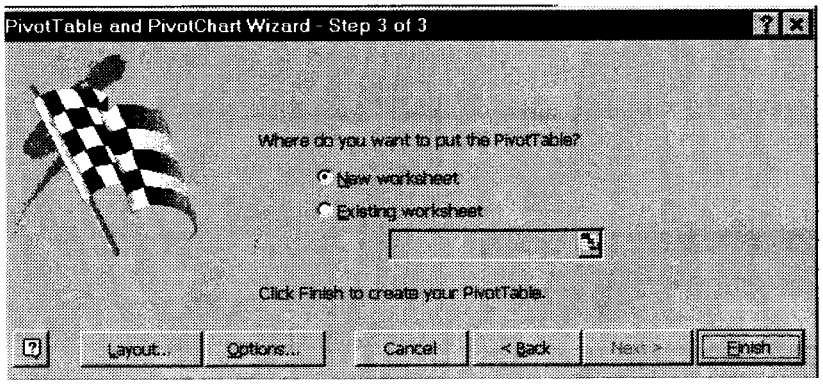
Start by bringing up a blank Excel worksheet and filling in the cells with the data as displayed in Figure]. Then highlight all the columns and rows and click "Data" on the toolbar. Click "PivotTable and PivotChart Report" and the following self-guiding display will appear (Figure 2):

Figure 2



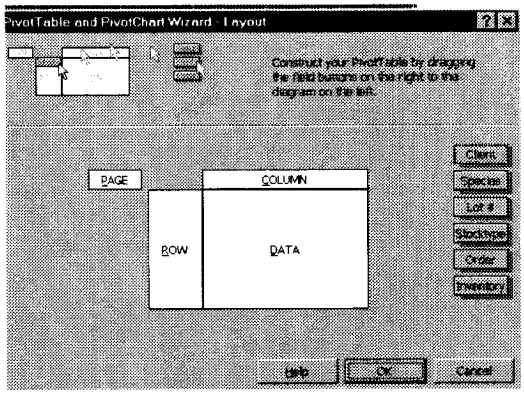
Select "Microsoft Excel list or database" and "PivotTable and click the "next" button. A wizard box ("Step 2 of 3") will appear. The "Range" field should have automatically been filled in when you highlighted the data. Continue by clicking "next" button. At this point you will see the following box (Figure 3):

Figure 3



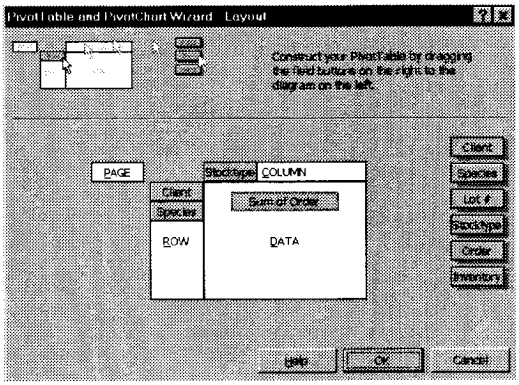
Select "New Worksheet" and click on the "Layout" button to begin building your summary sheet. Initially the blank layout form will look like Figure 4.

Figure 4



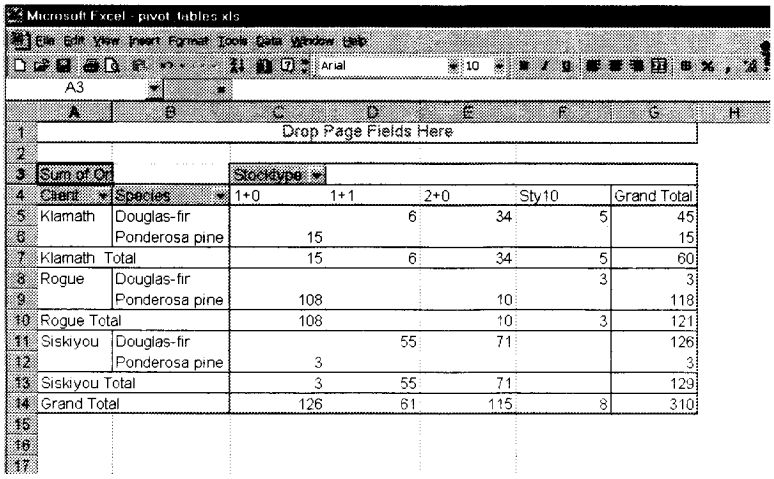
There are several ways to summarize this data. For example, let's summarize the inventory by client and species. Click and drag the field buttons titled "client" and "species" to the "ROW" box and the "Stock-type" field button to the "COLUMN" box as shown in Figure 5

Figure 5



Double click on the "Sum of Order" box and a screen will appear that gives you several ways to summarize the tables. Highlight "sum" (if it is not already highlighted) and click "OK". Click "OK" again and "finish". You should now see your data summarized as shown in Figure 6.

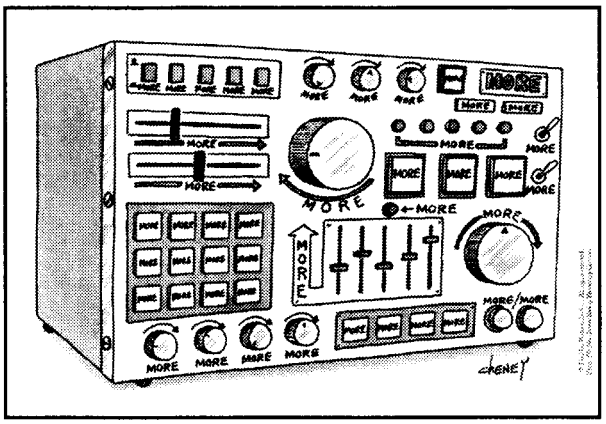
Figure 6

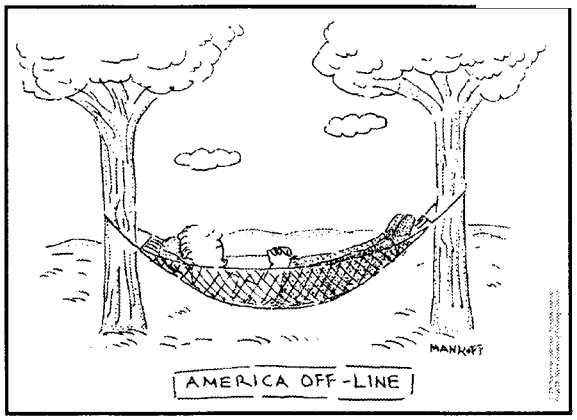


As you can see, the pivot table feature is a quick and easy way to summarize spreadsheet information.

Horticultural Humor

Instead of this—





—maybe we need this

New Nursery Literature

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Bareroot Production

1. **Effect of covering on the extension of F. *sylvatica, P. avium* and *A. pseudoplatanus* seedlings.** Andersen, L.; Bronnum, P.; Jensen, M. Acta Horticulturae 515:207-212. 2000.

2. **PennMulch use for seedbeds**. Flinn, C. C. International Plant Propagators' Society, combined proceedings 1999, 49:263-264. 2000. PennMulch is made from recycled and shredded newsprint, dry compressed into pellets that have 1N-3P-1K fertilizer incorporated into them.

3. **Seedling production in the northern plains.** Morgenson, G. International Plant Propagators' Society, combined proceedings 1999, 49:614-616. 2000.

Business Management

4. **Be prepared for labor audits.** Nursery Management and Production 17(5):73-76. 2001.

5. **The cost of noncompliance.** Nursery Management and Production 17(4):77-. 2001. Why it pays to adhere to Department of Labor regulations.

6. **Fit the task to the person.** Bartok, J. W., Jr. Greenhouse Management and Production 21(1):78-79. 2001.

7. **How big must a nursery firm be to produce a reasonable family income?** van Blokland, P. J.; Wang, M.; Haydu, J. J.; Hodges, A. W. Acta Horticulturae 536:223-230. 2000.

8. **Keep your records straight.** Whitcomb, C. E. Nursery Management and Production 16(12):55-57. 2000. Tracking detailed information can prevent disasters.

9. **Propagation safety.** Elliott, F. A. International Plant Propagators' Society, combined proceedings 1999, 49:5 80-5 83. 2000.

10. **Should you start your own business?** Thomas, P. A.; Thomas, W. A. Greenhouse Management and Production 21(6):20-27. 2001. 10 questions you need to answer before you invest.

11. **Steps in the development of a new nursery.** Ravenwood, I. International Plant Propagators' Society, combined proceedings 1999, 49:153-156. 2000. Experiences of North Forest Products building a container nursery in Tasmania.

Container Production

12. © **Changes in interior Douglas-fir root development in containers after copper and auxin treatments.** Dumroese, R. K. Western Journal of Applied Forestry 15(4):213-216. 2000.

13. **Getting oriented.** Huang, B. K. American Nurseryman 192(10):33-34. 2000. Properly designed containers can produce quality plants with health root systems.

14. **Growing plants in a cinder block.** Whitcomb, C. International Plant Propagators' Society, combined proceedings 1999, 49:527-531. 2000.

15. **Measuring copper root-pruning effect.** Nelson, W. R. International Plant Propagators' Society, combined proceedings 1999, 49:119-123. 2000.

16. **The problems with copper-treated pots: 7 reasons why I don't recommend this increasingly common practice.** Whitcomb, C. E. Nursery Management and Production 17(2):76-78. 2001.

17. **Root pruning can influence first order lateral root development of containerized plants.** Nelson, W. R. International Plant Propagators' Society, combined proceedings 1999, 49:96-103. 2000.

18. **Tackling heat stress.** Mathers, H. Nursery Management and Production 17(3):73-74, 76, 78. 2001. High container temperatures can seriously limit plant growth.

Diverse Species

19. **Comparing perceptions of native status.** Smith, S. E.; Window, S. R. Native Plants Journal 2(1):5-11. 2001.

20. **Differential effects of four abiotic factors on the germination of salt march annuals.** Noe, G. B.; Zedler, J. B. American Journal of Botany 87(11):16791692. 2000.

21. © **Dormancy-breaking and germination requirements of seeds of four *Lonicera* species (Caprifoliaceae) with underdeveloped spatulate embryos.** Hidayati, S. N.; Baskin, J. M.; Baskin, C. C. Seed Science Research 10(4):459-469. 2000.

22. **Early harvest of squirreltail seed.** Doescher, P. S. Journal of Range Management 54(2):197-199. 2001.

23. **The effect of salinity on different developmental stages of an endemic annual plant, *Aster laurentianus* (Asteraceae).** Houle, G.; Morel, L.; Reynolds, C. E.; Siegel, J. American Journal of Botany 88(1):62-67. 2001.

24. © **Effects of habitat nutrients and seed sources on growth and expansion of *Typha domingensis.*** Miao, S.; Newman, S.; Sklar, F. H. Aquatic Botany 68(4):297311. 2000. Cattails in the Everglades.

25. **Effects of stratification and GA3 on seed germination of a sand stabilizing grass *Leymus arenarius* used in reclamation.** Greipsson, S. Seed Science and Technology 29(1):1-10. 2001.

26. **Ethnobotany, culture, management, and use of common camas.** Stevens, M.; Darris, D. C.; Lambert, S. M. Native Plants Journal 2(1):47-53. 2001.

27. **Experiences establishing native wetland plants in a constructed wetland.** Steinfeld, D. Native Plants Journal 2(1):3 7-41. 2001.

28. **Germination conditions for *Briza subaristata:* pretreatments and temperature effects.** Ferrari, L.; Lopez, C. Seed Science and Technology 28:631-639. 2000. A native grass of the humid Argentine pampa prairie.

29. **Germination improvement of *Atriplex nummularia* (Chenopodiaceae) by pericarp elimination.** Peluc, S. L; Parera, C. A. Seed Science and Technology 28(3):559-566. 2000.

30. © **Germination studies of three dwarf shrubs *(Vaccinium,* Ericaceae) of Northern Hemisphere coniferous forests.** Baskin, C. C.; Milberg, P.; Andersson, L.; Baskin, J. M. Canadian Journal of Botany 78(12):1552-1560. 2000.

31. **Influence of seed age and inbreeding on germination and seedling growth in *Hibiscus moscheutos* (Malvaceae).** Liu, H.; Spira, T. P. Journal of the Torrey Botanical Society 128(1):16-24. 2001.

32. **Irrigation and mulch effects on desert shrub transplant establishment.** Bainbridge, D.; Tiszler, J.; MacAller, R.; Allen, M. F. Native Plants Journal 2 (1):25-29. 2001.

33. © **Merits of native and introduced Triticeae grasses on semiarid rangelands.** Asay, K. H.; Horton, W. H.; Jensen, K. B.; Palazzo, A. J. Canadian Journal of Plant Science 81(1):45-52. 2001.

34. © **Microbial enhancement of seed germination in *Rosa corymbifera 'Laxa'.*** Morpeth, D. R.; Hall, A. M. Seed Science Research 10(4):489-494. 2000.

35. **Morphophysiological dormancy in seeds of *Chamaelirium luteum,* a long-lived dioecious lily.** Baskin, C. C.; Baskin, J. M.; Chester, E. W. Journal of the Torrey Botanical Society 128(1):7-15. 2001.

36. **Mycorrhizal fungi and cold-assisted symbiotic germination of the federally threatened eastern prairie fringed orchid, *Platanthera leucophaea* (Nuttall) Lindley.** Zettler, L. W.; Stewart, S. L.; Bowies, M. L.; Jacobs, K. A. American Midland Naturalist 145(1):168-175. 2001.

37. **Native or not: subjective labels and their application in wildland plantings.** Kitchen, S. G.; McArthur, E. D. Native Plants Journal 2(1):21-24. 2001.

38. **Nonlocal transplantation and outbreeding depression in the subshrub *Lotus scoparius* (Fabaceae).** Montalvo, A. M.; Ellstrand, N. C. American Journal of Botany 88(2):258-269. 2001.

39. **Nonsymbiotic seed propagation of two Japanese native orchids for native restoration.** Fukasawa, K.; Kage, Y. International Plant Propagators' Society, combined proceedings 1999, 49:667-668. 2000.

40. **Observations on seed propagation of 5 Mississippi wetland species.** Grabowski, J.M. Native Plants Journal 2(1):67-68. 2001.

41. **Perigynium removal and cold, moist stratification improve germination of *Carex nebrascensis* (Nebraska sedge).** Hoag, J. C.; Dumroese, R. K.; Sellers, M. E. Native Plants Journal 2(1):63-68. 2001.

42. **Plants for ecological restoration: a foundation and a philosophy for the future.** Booth, D. T.; Jones, T. A. Native Plants Journal 2(1):12-20. 2001.

43. **Propagation of *Dicksonia antarctica.*** van der Staay, T. International Plant Propagators' Society, combined proceedings 1999, 49:178-180. 2000. A tree fern from Australia and Tasmania, which is propagated by spores.

44. **Propagation of endangered species: variable germination of pink sand verbena from Pacific Coast beaches.** Kaye, T. N. International Plant Propagators' Society, combined proceedings 1999, 49:617-621. 2000.

45. **The propagation of native plants.** Metcalf, L. International Plant Propagators' Society, combined proceedings 1999, 49:89-92. 2000.

46. **Propagation of promising high-elevation species native to the Colorado Plateau.** Busco, J. K.; Maschinski, J. International Plant Propagators' Society, combined proceedings 1999, 49:576-580. 2000.

47. **Propagation protocol for *Gordonia lasianthus.*** Colodney, E. Native Plants Journal 2(1):42-43. 2001.

48. **Propagation protocol for Lizard's tail *(Saururus cernuus).*** Bennett, D. J. Native Plants Journal 2(1):44-45. 2001.

49. **Propagation protocol for ninebark *(Physocarpus opulifolius).*** Hoss, G. A. Native Plants Journal 2(1):60-61. 2001.

50. © **Restoration ecology of an endangered plant species: establishment of new populations of *Cirsium pitcheri.*** Rowland, J.; Maun, M. A. Restoration Ecology 9(1):60-70. 2001.

51. **Revegetation of a San Francisco coastal salt marsh.** Heimbinder, E. Native Plants Journal 2(1):5459. 2001.

52. **Riparian zone restoration: field requirements and nursery opportunities.** Hoag, J. C.; Landis, T. D. Native Plants Journal 2(1):30-35. 2001.

53. **Seed treatment of New Zealand *Sophora* species with concentrated sulfuric acid to hasten germination.** Appleton, E. J. International Plant Propagators' Society, combined proceedings 1999, 49:113-114. 2000.

54. **Soil amendments and planting techniques: campsite restoration in the Eagle Cap Wilderness, Oregon. Cole,** D. N.; Spildie, D. R. IN: USDA Forest Service, Rocky Mountain Research Station, Proceedings RMRS-P-15, p. 181-187. Wilderness science in a time of change conference, v.5: wilderness ecosystems, threats, and management. 2000.

55. **Starting new populations of longleaf pine ground-layer plants in the outer coastal plain of South Carolina, USA.** Glitzenstein, J. S.; Streng, D. R.; Wade, D. D.; Brubaker, J. Natural Areas Journal 21 (1):89-110. 2001.

56. **Studies on the ecological life cycle of the native winter annual grass *Alopecurus carolinianus,* with particular reference to seed germination biology in a floodplain habitat.** Baskin, C. C.; Baskin, J. M.; Chester, E. W. Journal of the Torrey Botanical Society 127(4):280-290. 2000.

57. © **Survival of introduced *Tuber melanosyorum* at two sites in Israel as measured by occurrence of mycorrhizas.** Kagan-Zur, V.; Freeman, S.; Luzzati, Y.; Roth-Bejerano, N.; Shabi, E. Plant and Soil 229(2):159166. 2001. Spores of the black truffle were used to inoculate oak seedlings and hazel suckers.

58. **Tasmania native orchids: their propagation and culture.** Smith, J. F. International Plant Propagators' Society, combined proceedings 1999, 49:173-177. 2000.

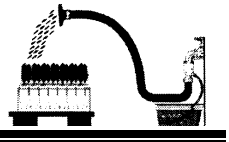
59. **Two ways to crack the nut -*Aesculus parviflora.*** Jones, A. M. International Plant Propagators' Society, combined proceedings 1999, 49:313-317. 2000.

60. **Using a laundry spin dryer to remove surface water from seeds.** Creasey, W.; Creasey, K. Native Plants Journal 2(1):62. 2001.

SO. 100 easy-to-grow native plants for American gardens in temperate zones. Johnson, L. Firefly Books, Ltd. 160 p. 1999. ORDER FROM: any book seller. ISBN I-552009-327-1.

SO. The New England Wild Flower Society Guide to growing and propagating wildflowers in the United States and Canada. Cullina, W. Houghton Mifflin Co. 322 p. 2000. ORDER FROM: any book seller. ISBN 0-395-96609-4. Contents: Statement on wild collection; Ecological gardening (Light, soil, temperature, diseases); Floristic provinces; Encyclopedia of plants; Propagation (seed, germination, cuttings); Wildflowers for various sites; Sources of propagated native plants and seeds.

Fertilization and Nutrition



61. © **Ammonium and nitrate acquisition by plants in response to elevated CO_2 concentration: the roles of root physiology and architecture.** Bauer, G. A.; Berntson, G. M. Tree Physiology 21(2-3):137-144. 2001.

62. © **Are differences in root growth of nitrogen catch crops important for their ability to reduce soil nitrate-N content, and how can this be measured?** Thorup-Kristensen, K. Plant and Soil 230(2):185-195. 2001.

63. © **Effects of nutrient supply on photosynthetic acclimation and photoinhibition of one-year-old foliage of *Picea abies.*** Grassi, G.; Colom, M. R.; Minolta, G. Physiologia Plantarum 111(2):245-254. 2001.

64. © **Effects of serpentine soil factors on Virginia pine *(Pinus virginiana)* seedlings.** Miller, S. P.; Gumming, J. R. Tree Physiology 20(16):1129-1135. 2000.

65. © **Foliar urea pretreatment tempers inefficient N recovery resulting from copper chelate (CuEDTA) defoliation of apply nursery plants.** Guak, S.; Cheng, L.; Fuchigami, L. H. Journal of Horticultural Science and Biotechnology 76(1):35-39. 2001.

66. © **Influence of elevated CO_2 and mycorrhizae on nitrogen acquisition: contrasting responses in *Pinus taeda*** and ***Liquidambar styraciflua.*** Constable, J. V. H.; Bassirirad, H.; Lussenhop, J.; Zerihun, A. Tree Physiology 21(2-3):83-91. 2001.

67. © **The influence of nitrogen supply on growth and internal recycling of nitrogen in young *Nothofagus fusca* trees.** Stephens, D. W.; Millard, P.; Turnbull, M. H.; Whitehead, D. Australian Journal of Plant Physiology 28:249-255. 2001.

68. © **Interactive effects of elevated CO_2 concentration and nitrogen supply on partitioning of newly fixed ^{13}C and ^{15}N between shoot and roots of pedunculate oak seedlings *(Quercus robur).*** Maillard, P.; Guehl, J. M.; Muller, J. F.; Gross, P. Tree Physiology 21(2-3):163-172.2001.

69. © **Long-term effects of lime application on ^{15}N availability to Sitka spruce seedlings growing in pots containing peat soils.** Kakei, M.; Clifford, P. E. Forestry 71(4):393-401. 2000.

70. © **Natural and induced cadmium-accumulation in poplar and willow: implications for phytoremediation.** Robinson, B. H.; Mills, T. M.; Petit, D.; Fung, L. E.; Green, S. R.; Clothier, B. E. Plant and Soil 227(1-2):301-306. 2000.

71. © **Nitrogen and base cation uptake in seedlings of *Acer pseudoplatanus* and *Calamagrostis villosa* exposed to an acidified environment.** Gloser, V.; Gloser, J. Plant and Soil 226(1):71-77. 2000.

72. © **Organic farming: challenge of timing nitrogen availability to crop nitrogen requirements.** Pang, X. P.; Letey, J. Soil Science Society of America Journal 64 (1):247-253. 2000.

73. © **Response of western hemlock crosses to nitrogen and phosphorus supply.** Hawkins, B. J.; Henry, G.; King, J. New Forests 20(2):135-143. 2000.

74. © **Root system architecture and receptivity to mycorrhizal infection in seedlings of *Cedrus atlantica* as affected by nitrogen source and concentration.** Boukcim, H.; Pages, L.; Plassard, C.; Mousain, D. Tree Physiology 21(2-3):109-115. 2001.

75. © **Salt tolerance screening of selected Australian woody species -- a review.** Niknam, S. R.; McComb, J. Forest Ecology and Management 139(1-3):1-19. 2000.

76. © **Soil and crop response to variable-rate liming for two Michigan fields.** Pierce, F. J.; Warncke, D. D. Soil Science Society of America Journal 64(2):774-780. 2000.

77. © **Soluble proteins and dehydrins in nitrogen-fertilized Scots pine seedlings during deacclimation and the onset of growth.** Kontunen-Soppela, S.; Taulavuori, K.; Taulavuori, E.; Lahdesmaki, P.; Laine, K. Physiologia Plantarum 109(4):404-409. 2000.

78. © **Trends in rhizobial inoculant production and use.** Catroux, G.; Hartmann, A.; Revellin, C. Plant and Soil 230(1):21-30. 2001.

79. © **Use of urea to correct immature urban composts for agricultural purposes.** Madrid, F.; Murillo, J. M.; Lopez, R.; Cabrera, F. Communications in Soil Science and Plant Analysis 31(15-16):2635-2649. 2000.

General and Miscellaneous

80. © **Afforestation in Israel: a source of social goods and services.** Ginsberg, P. Journal of Forestry 98(3):32-36. 2000. Tree planting has played a pivotal role in renewing Israel's battered Mediterranean landscape, enhancing not only its physical development but also social development by providing employment, recreational, educational, and commodity services.

81. **The current state and problems of forest regeneration in the north of European Russia.** Babich, N. A.; Barabin, A. L; Tutygin, G. S. IN: Forest regeneration in the northern parts of Europe, p. 35-40. Finnish Forest Research Institute, Research Papers 790. 2000.

82. **Planting stock production and increasing forest yield in the north of European Russia.** IN: Forest regeneration in the northern parts of Europe, p. 141-146. Finnish Forest Research Institute, Research Papers 790. 2000.

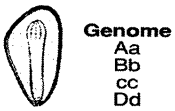
83. © **Reforestation rules in Oregon: lessons learned from strict enforcement.** Rose, R.; Coate, J. Journal of Forestry 98(5):24-28. 2000.

84. **Return of the giants: restoring white pine ecosystems by breeding and aggressive planting of blister rust-resistant white pines.** Fins, L.; Byler, J.; Ferguson, D.; Harvey, A.; Mahalovich, M. F.; McDonald, G.; Miller, D.; Schwandt, J.; Zack, A. University of Idaho, Idaho Forest, Wildlife and Range Experiment Station, Station Bulletin 72. 2001.

85. **Seedling production for reforestation.** Rikala, R. IN: Forest regeneration in the northern parts of Europe, p. 127-140. Finnish Forest Research Institute, Research Papers 790. 2000. In Finland.

86. © **Some considerations when using a microwave oven as a laboratory research tool.** Diprose, M. F. Plant and Soil 229(2):271-280. 2001.

Genetics and Tree Improvement



87. © **Genetic selection for cold hardiness in coastal Douglas-fir seedlings and saplings.** O'Neill, G. A.; Aitken, S. N.; Adams, W. T. Canadian Journal of Forest Research 30(11):1799-1807. 2000.

88. © **Genotypic diversity and clone size in old-growth populations of coast redwood (*Sequoia sempervirens*).** Rogers, D. L. Canadian Journal of Botany 78(11):1408-1419. 2000.

89. © **Genotypic variation in carbon isotope discrimination and gas exchange of ponderosa pine seedlings under two levels of water stress.** Olivas-Garcia, J. M.; Cregg, B. M.; Hennessey, T. C. Canadian Journal of Forest Research 30(10):1581-1590. 2000.

90. © **Provenances and families show different patterns of relationship between bud set and frost hardiness in Picea abies.** Johnsen, O.; Skroppa, T. Canadian Journal of Forest Research 30:1858-1866. 2000.

91. © **Variation among seed sources of silver birch in Scotland.** Worrell, R.; Cundall, E. P.; Malcolm, D. C.; Ennos, R. A. Forestry 73(5):419-435. 2000.

Mycorrhizae & Beneficial Microorganisms

92. © **Does origin of mycorrhizal fungus or mycorrhizal plant influence effectiveness of the mycorrhizal symbiosis?** Van der Heijden, E. W.; Kuyper, T. W. Plant and Soil 230(2):161-174. 2001.

93. © **Effects of inoculation with PGPR *Bacillus* and *Pisolithus tinctorius* on *Pinus pinea* L. growth, bacterial rhizosphere colonization, and mycorrhizal infection.** Probanza, A.; Mateos, J. L.; Lucas Garcia, J. A.; Felipe, M. R. de; Gutierrez Manero, F. J. Microbial Ecology 41(2):140-148. 2001.

94. **Effects of various nitrogen loads on the nitrate reductase activity in roots and mycorrhizas of Norway spruce seedlings.** Brnner, L; Brodbeck, S.; Genenger, M. Phyton 40(4):43-48. 2000.

95. © ***Glomus claroideum*, an arbuscular mycorrhizal fungus new to Ireland, and its distribution in an Irish tree nursery.** O'Neill, J. J. M.; Mitchell, D. T. Proceedings of the Royal Irish Academy 99B(3):197-203. 1999.

96. © **The impacts of broadcast burning after clearcutting on the diversity of ectomycorrhizal fungi associated with hybrid spruce seedlings in central British Columbia.** Mah, K.; Tackaberry, L. E.; Egger, K. N.; Massicotte, H. B. Canadian Journal of Forest Research 31(2):224-235. 2001.

97. **Improved production of nursery stock of Taxus baccata L. through management of the arbuscular mycorrhizal symbiosis.** Sainz, M. J.; Iglesias, L; Vilarino, A.; Pintos, C.; Mansilla, J. P. Acta Horticulturae 536:379-384. 2000.

98. © **Influence of two plant growth-promoting rhizobacteria on loblolly pine root respiration and IAA activity.** Vonderwell, J. D.; Enebak, S. A.; Samuelson, L. J. Forest Science 47(2):197-202. 2001.

99. © **Laboratory experiments imply the conditionality of mycorrhizal benefits for Salix repens: role of pH and nitrogen to phosphorus ratios.** Van der Heijden, E. W.; Kuyper, T. W. Plant and Soil 228(2):275-290. 2001.

100. © **Longevity of mycorrhizal roots depends on branching order and nutrient availability.** Majdi, H.; Damm, E.; Nylund, J. E. New Phytologist 150(1);195-202. 2001.

101. © **Mycelium of arbuscular mycorrhizal fungi (AMF) from different genera: form, function and detection.** Dodd, J. C.; Boddington, C. L.; Rodriguez, A.; Gonzalez-Chavez, C.; Mansur, I. Plant and Soil 226 (2):131-151. 2000.

102. © **Nutrient economy of red pine is affected by interactions between *Pisolithus tinctorius* and other forest-floor microbes.** Koide, R. T.; Kabir, Z. New Phytologist 150(1):179-188. 2001.

103. © **The potential for woody understory plants to provide refuge for ectomycorrhizal inoculum at an interior Douglas-fir forest after clear-cut logging.** Hagerman, S. M.; Sakakibara, S. M.; Durall, D. M. Canadian Journal of Forest Research 31(4):711-721. 2001.

Nursery Structures & Equipment

104. **The basics of shading for proper temperature control.** Bartok, J. W., Jr. Greenhouse Management and Production 21(5):72-73. 2001.

105. **Beyond temperature control.** Flood, D. Greenhouse Management and Production 21(3):24-26, 28. 2001. How can you maintain a stable climate in a greenhouse against the dynamics of everyday weather?

106. **Building a new greenhouse?** Bartok, J. W., Jr. Greenhouse Management and Production 21(4):74, 76, 77. 2001. Lists things to consider before signing a contract with a builder.

107. **Don't let lightning zap you.** Woolsey, J. Greenhouse Management and Production 20(11):46-51. 2000. Increased use of computers and microprocessor-based devices in greenhouses has made them vulnerable to lightning strikes.

108. **The glazing puzzle.** Greenhouse Management and Production 21(4):50-52. 2001. Different light properties impact how plants grow in a greenhouse. Learn how to fit the pieces together to maximize these properties, control growth and prevent disease.

109. **Greenhouse structures and coverings.** McKay, A. Greenhouse Management and Production 21(4):42-44, 46, 49. 2001.

110. **How to control energy costs.** Short, T. H. Greenhouse Management and Production 21(4):18-20, 22-23. 2001.

111. **Inspect new construction.** Bartok, J. W., Jr. Greenhouse Management and Production 21(6):68-69. 2001. Inspect your new greenhouse while it is being built to ensure that the plans, specifications and contract are being followed.

112. **Maintenance: a necessary part of mechanization.** Bartok, J. W., Jr. Greenhouse Management and Production 20(11):80-81. 2000.

113. **What to know before building a greenhouse.** McKay, A. Greenhouse Management and Production 21 (6):28-30. 2001. Site selection, water supply, availability of utilities, and required permits must be considered before construction begins.

Outplanting Performance

114. © **Acclimation to light in planted and naturally regenerated populations of white spruce seedlings.** Awada, T.; Redmann, R. E. Canadian Journal of Botany 78(12):1495-1504. 2000.

115. **An approach to the development of standardized measures for forest regeneration success in Australia.** Van Der Meer, P. J.; Dignan, P. IN: International conference on indicators for sustainable forest management, p. 171-172. Held August 24-28, 1998, Melbourne, Australia. 1998.

116. © **Cluster afforestation for creating diverse mountain forest. structures - a review.** Schonenberger, W. Forest Ecology and Management 145(1-2):121-128. 2001.

117. **A comparative study of plant vitality tests and field performance of eleven tree species.** Radoglou, K.; Raftoyannis, Y. Phyton 40(4):163-168. 2000.

118. © **Determining the pattern of oak woodland regeneration for a cleared watershed in northwest California: a necessary first step for restoration.** Brooks, C. N.; Merenlender, A. M. Restoration Ecology 9(1):1-12. 2001.

119. © **Effects of a willow overstory on planted seedlings in a bottomland restoration.** Dulohery, C. J.; Kolka, R. K.; McKevlin, M. R. Ecological Engineering 15(Suppl):S57-S66. 2000.

120. **Effects of desiccation and freezing on vitality and field performance of broadleaved tree species.** Radoglou, K.; Raftoyannis, Y. Annals of Forest Science 58(1):59-68. 2001.

121. © **Effects of reafforestation techniques on the nutrient content, photosynthetic rate and stomata) conductance of Pinus halepensis seedlings under semiarid conditions.** Diaz, E.; Roldan, A. Land Degradation and Development 11(5):475-486. 2000.

122. © **Establishing white spruce in the boreal white and black spruce zone.** Site preparation trials at Wonowon and Iron creek, British Columbia. Bedford, L.; Sutton, R. F.; Stordeur, L.; Grismer, M. New Forests 20(3):213-233. 2000.

123. © **Evaluation of an attempt to cultivate shrubs and trees on a heap of a potash mine.** Kahl, L.; Kluge, R.; Thomas, S. Landscape and Urban Planning 51(2-4):109-112. 2000.

124. © **Frost damage to planted Norway spruce seedlings -- influence of site preparation and seedling type.** Langvall, O.; Nilsson, U.; Orlander, G. Forest Ecology and Management 141(3):223-235. 2001.

125. © **Germination and survival of tree species in disturbed forests of the highlands of Chiapas, Mexico.** Camacho-Cruz, A.; Gonzalez-Espinosa, M.; Wolf, J. H. D.; De Jong, B. H. J. Canadian Journal of Botany 78(10):1309-1318. 2000.

126. **The growth of Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*) seedlings on hydrologically and nutritionally contrasting till soils in Finnish Lapland.** Sutinen, M. L.; Salmela, S.; Sutinen, R.; Vapaavuori, E. Phyton 40(4):175-178. 2000.

127. © **Models of low temperature and high irradiance and their application to explaining the risk of seedling mortality.** Blennow, K.; Lindkvist, L. Forest Ecology and Management 135(1-3):289-301. 2000.

128. © **Morphological and physiological attributes of root systems and seedling growth in three different Picea glauca reforestation stock.** Krasowski, M. J.; Owens, J. N. Canadian Journal of Forest Research 30 (11):1669-1681. 2000.

129. © **Operational restoration of the Pen Branch bottomland hardwood and swamp wetlands - the research setting.** Nelson, E. A.; Dulohery, N. C.; Kolka, R. K.; McKee, W. H., Jr. Ecological Engineering 15(Suppl):S23-S33. 2000.

130. © **The physiological basis for the establishment of bare-root larch seedlings.** McKay, H. M.; Morgan, J. L. Forest Ecology and Management 142(1-3):1-18. 2001.

131. © **Restoring bottomland hardwood ecosystems in the lower Mississippi alluvial valley.** Stanturf, J. A.; Gardiner, E. S.; Hamel, P. B.; Devall, M. S.; Leininger, T. D.; Warren, M. E., Jr. Journal of Forestry 98(8):10-16. 2000.

132. © **Seedling emergence of Pinus sylvestris in characterized seedbed substrates under different moisture conditions.** Oleskog, G.; Grip, H.; Bergsten, U.; Sahlen, K. Canadian Journal of Forest Research 30 (1 1):1766-1777. 2000.

133. © **Survival and early development of lodgepole pine.** Varmola, M.; Salminen, H.; Rikala, R.; Kerkela, M. Scandinavian Journal of Forest Research 15(4):410423. 2000.

134. © **Survival and growth of black and white spruce seedlings in relation to stock type, site preparation and plantation type in southeastern Manitoba.** Wang, G. G.; Siemens, J. A.; Keenan, V.; Philippot, D. Forestry Chronicle 76(5):775-782. 2000.

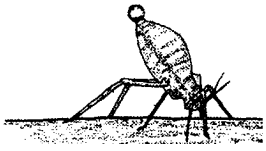
135. © **Ten-year growth and survival of Douglas-fir seedlings treated with plant growth regulating substances at transplant.** Scagel, C. F.; Linderman, R. G.; Scagel, R. K. Canadian Journal of Forest Research 30(11):1778-1787. 2000.

136. © **The use of natural processes in reclamation advantages and difficulties.** Bradshaw, A. Landscape and Urban Planning 51(2-4):89-100. 2000.

137. © **The use of tree shelters in restoring forest species to a floodplain delta: 5-year results.** Conner, W. H.; Inabinette, L. W.; Brantley, E. F. Ecological Engineering 15(Suppl):S47-S56. 2000.

138. **Water relations root growth potential and plant survival of cold stored Pinus radiata D. Don seedlings.** Mena-Petite, A.; Omega-Lasuen, U.; Gonzalez-Moro, B.; Lacuesta, M.; Munoz-Rueda, A. Phyton 40(4):143-148. 2000.

Pest Management



139. **Addition of beneficial microorganisms to growth media: an overview.** Borregaard, S. International Plant Propagators' Society, combined proceedings 1999, 49:426-429. 2000.

140. **The basics of biorationals.** Brownbridge, M. Greenhouse Grower 19(2):22, 24, 26, 30, 32, 34. 2001. Explores the use of different types of biorational pesticides, a group that pose minimal risk to the environment due to their chemical make-up, rapid degradation, or the small amount required to effect control.

141. © **Biocontrol of cucumber diseases in the field by plant growth-promoting rhizobacteria with and without methyl bromide fumigation.** Raupach, G. S.; Kloepper, J. W. Plant Disease 84(10):1073-1075. 2000.

142. **Biocontrols for disease are here to stay.** Nameth, S. T. Greenhouse Management and Production 21(2):6467. 2001.

143. **Biological fungicides: why these products are becoming more common.** Hattori, K. Nursery Management and Production 16(11):55-58. 2000.

144. **Biological remediation of damping off on conifer seedlings at Meadow Lake Nursery Company.** Armstrong, M. International Plant Propagators' Society, combined proceedings 1999, 49:259-262. 2000. Seeds were treated with Zerotol, which is formed by the fusion of hydrogen dioxide with peroxyacetic acid.

145. **Cleanliness in propagation with the use of Agribrom.** Klupenger, D. International Plant Propagators' Society, combined proceedings 1999, 49:602-603. 2000.

146. **Control of Botrytis during plant propagation.** Mahaffee, W. International Plant Propagators' Society, combined proceedings 1999, 49:543-551. 2000.

147. **Dealing with disease in high humidity environments: strategies for control in fog and mist zones.** Spreitler, R. K. International Plant Propagators' Society, combined proceedings 1999, 49:608-613. 2000.

148. **Diagnosis and management of bacterial diseases.** Wick, R. L. Greenhouse Management and Production 21 (2):28-30, 32. 2001. Bacterial cause a variety of symptoms that can be similar to those caused by fungi, so find out which distinct features you should look for.

149. © **Disease progression by active mycelial growth and biocontrol of Pythium ultimum var. ultimum studied using a rhizobox system.** Green, H.; Jensen, D. F. Phytopathology 90(9):1049-1055. 2000.

150. **Diseases associated with whitebark pine seedling production, USDA Forest Service Nursery, Coeur d'Alene, Idaho.** James, R. L.; Burr, K. E. USDA Forest Service, Northern Region, Forest Health Protection, Report 00-8. 11 p. 2000.

151. **Effect of soil solarization and cover crops on populations of selected soilborne plant pathogens in western Oregon.** Pinkerton, J. N.; Ivors, K. L.; Miller, M. L.; Moore, L. W. Plant Disease 84(9):952-960. 2000.

152. © **Effect of Trichoderma fungi on soil micromycetes that cause infectious conifer seedling lodging in Siberian tree nurseries.** Yakimenko, E. E.; Grodnitskaya, I. D. Microbiologia 69(6):726-729. 2000.

153. **Effects of a 2-year fallow period on soil populations of Fusarium, *Trichoderma and* Pythium species after incorporating corn plant residues -USDA Forest Service Nursery, Coeur d'Alene, Idaho.** James, R. L. USDA Forest Service, Northern Region, Forest Health Protection, Report 00-17. 11 p. 2000.

154. **Effects of bare fallowing on Fusarium-associated root diseases and production of bare root ponderosa pine seedlings at the USDA Forest Service Lucky Peak Nursery, Boise, Idaho.** James, R. L.; Beall, K. USDA Forest Service, Northern Region, Forest Health Protection, Report 00-3. 13 p. 2000.

155. **Effects of topical application of the biological control agent Biotrek on production of bareroot Douglas-fir and western white pine seedlings, USDA Forest Service nursery, Coeur d'Alene, Idaho.** James, R. L. USDA Forest Service, Northern Region, Forest Health Protection Report 00-5. 8 p. 2000.

156. **Evaluation of methyl iodide for control of peach replant disorder.** Eayre, C. G.; Sims, J. J.; Ohr, H. D.; Mackey, B. Plant Disease 84(10):1177-1179. 2000.

157. © **Fungicidal control of *Lophodermium seditiosum* on *Pinus sylvestris* seedlings in Swedish forest nurseries.** Stenstrom, E.; Arvidsson, B. Scandinavian Journal of Forest Research 16(2):147-154. 2001.

158. © **Genetic analysis of isolates of Botrytis *cinerea* sensitive and resistant to benzimidazole and dicarboximide fungicides.** Yourman, L. F.; Jeffers, S. N.; Dean, R. A. Phytopathology 90(8):851-859. 2000.

159. **How to decrease pest control costs.** McCaffrey, B. T. Nursery Management and Production 17(5):62-67. 2001. Save big bucks through sanitation, pest identification and crop rotation. Life cycles and control techniques for aphids, thrips, whiteflies, scale, and spider mites are discussed.

160. © **Impact of *Leptoglossus occidentalis* (Hemiptera: Coreidae) on Douglas-fir seed production.** Bates, S. L.; Borden, J. H.; Kermode, A. R.; Bennett, R. G. Journal of Economic Entomology 93 (5):1444-1451. 2000.

161. **Integrated plant disease control.** Labuschagne, N. International Plant Propagators' Society, combined proceedings 1999, 49:68-71. 2000.

162. **Investigations of tree health at the Potlatch Corporation Cherrylane Seed Orchard, Idaho.** James, R. L. USDA Forest Service, Northern Region, Forest Health Protection, Report 00-14. 15 p. 2000.

163. **Moving to biocontrols.** Henderson, J. Nursery Management and Production 17(3):31-32, 34-37. 2001. Learning to combine traditional and biological techniques is the key.

164. **Pathogenic characteristics of *Fusarium acuminatum* isolated from inland Pacific Northwest nurseries.** James, R. L. USDA Forest Service, Northern Region, Forest Health Protection, Report 00-16. 8 p. 2000.

165. **Pathogenic characteristics of *Fusarium solani* isolated from inland Pacific Northwest forest nurseries.** James, R. L.; Perez, R. USDA Forest Service, Northern Region, Forest Health Protection, Report 00-15. 12 p. 2000.

166. **Propagation pest control.** Miller, F. Nursery Management and Production 16(12):32-34, 36-37. 2000. Use sanitation to stay ahead of shoreflies and fungus gnats.

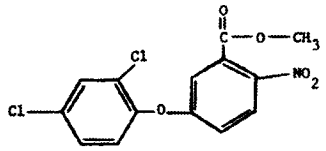
167. **Root diseases of bareroot western larch seedlings - USDA Forest Service Nursery, Coeur d'Alene, Idaho.** James, R. L. USDA Forest Service, Northern Region, Nursery Disease Notes No. 141. 10 p. 2000.

168. © **Selective media for the specific isolation and enumeration of Botrytis *cinerea* conidia.** Edwards, S. G.; Seddon, B. Letters in Applied Microbiology 32 (2):63-66. 2001.

169. **Technology provides state-of-the-art disease diagnosis.** Nameth, S. T. Greenhouse Management and Production 21(6):64, 66-67. 2001. New technologies for plant disease diagnosis include cyber-diagnosis, DNA-based technology, and immuno-diagnostics.

170. © **Water stress and *Sphaeropsis sapinea* as a latent pathogen of red pine seedlings.** Stanosz, G. R.; Blodgett, J. T.; Smith, D. R.; Kruger, E. L. New Phytologist 149(3):531-538. 2001.

171. © **What's a picture worth? The use of modern telecommunications in diagnosing plant diseases.** Holmes, G. J.; Brown, EA.; Ruhl, G. Plant Disease 84 (12):1256-1265. 2000.



Pesticides

172. **As EPA cracks down on chemicals, scouting becomes more critical for nurseries.** Walker, B. The Digger 45(3):39-46. 2001. Biologicals become bigger part of pest programs, but timing is critical.

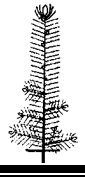
173. **Common and chemical names of herbicides approved by the Weed Science Society of America.** Weed Science 48(6):786-792. 2000.

174. **Effect of water pH on pest control materials.** Cloyd, R. Greenhouse Management and Production 20 (11):78-79. 2000. Water pH can negatively impact effectiveness of many pest control materials.

Seedling Harvesting and Storage

175. © **Effect of different lifting dates and different lengths of cold storage on plant vitality of silver birch and common oak.** Lindqvist, H. Scientia Horticulturae 88(2):147-161. 2001.

Seedling Physiology and Morphology



176. © **Assessment of root freezing damage of two-year-old white spruce, black spruce and jack pine seedlings.** Coursolle, C.; Bigras, F. J.; Margolis, H. A. Scandinavian Journal of Forest Research 15(3):343-353. 2000.

177. **Chlorophyll fluorescence as a tool in propagation.** Bruce, S. E.; Rowe, B. International Plant Propagators' Society, combined proceedings 1999, 49:276-280. 2000.

178. **Chlorophyll fluorescence characteristics, performance and survival of freshly lifted and cold stored Douglas fir seedlings.** Perks, M. P.; Monaghan, S.; O'Reilly, C.; Osborne, B. A.; Mitchell, D. T. Annals of Forest Science 58(3):225-235. 2001.

179. © **Cold-induced photoinhibition affects establishment of *Eucalyptus nitens* (Deane and Maiden) Maiden and *Eucalyptus globulus* Labill.** Close, D. C.; Beadle, C. L.; Brown, P. H.; Holz, G. K. Trees: Structure and Function 15(1):32-41. 2000.

180.© **Ecophysiological responses of *Araucaria angustifolia* (Araucariaceae) seedlings to different irradiance levels.** Duarte, L. da S.; Dillenburg, L. R. Australian Journal of Botany 48(4):531-537. 2000.

181. **Effect of accumulated duration of the light period on bud burst in Norway spruce *(Picea abies)* of varying ages.** Partanen, J.; Leinonen, L; Repo, T. Silva Fennica 35(1):111-117. 2001.

182. © **Effects of drought preconditioning on thermotolerance of photosystem II and susceptibility of photosynthesis to heat stress in cedar seedlings.** Ladjal, M.; Epron, D.; Ducrey, M. Tree Physiology 20 (18):1235-1241. 2000.

183. © **Effects of flood pre-conditioning on responses of three bottomland tree species to soil waterlogging.** Anderson, P. H.; Pezeshki, S. R. Journal of Plant Physiology 158(2):227-233. 2001.

184. © **Effects of light regimes on the growth of cherrybark oak seedlings.** Guo, Y.; Shelton, M. G.; Lockhart, B. R. Forest Science 47(2):270-277. 2001.

185. © **Effects of soil temperature on biomass and carbohydrate allocation in Scots pine *(Pinus sylvestris)* seedlings at the beginning of the growing season.** Domisch, T.; Finer, L.; Lehto, T. Tree Physiology 21 (7):465-472. 2001.

186. **The effects of submergence and light on two age classes of baldcypress *(Taxodium distichum* (L.) Richard) seedlings.** Souther, R. F.; Shaffer, G. P. Wetlands 20(4):697-706. 2000.

187. © **Effects of thawing procedure on frost hardiness, carbohydrate content and timing of bud break in *Picea abies.*** Floistad, I. S.; Kohmann, K. Scandinavian Journal of Forest Research 16(1):30-36. 2001.

188. © **Floret's use expands to more crops.** Konjoian, P. Greenhouse Management and Production 21(3):45-48, 50. 2001. The growth regulator Floret has an expanded label for floriculture crops. Learn how this ethylene-producing chemical affects plant growth and how it can be used on stock and finished plants.

189. © **Growth cessation and autumn-frost hardiness in one-year-old *Picea abies* progenies from seed orchards and natural stands.** Hannerz, M.; Westin, J. Scandinavian Journal of Forest Research 15(3):309-317. 2000.

190. © **Growth response of mountain birch to air and soil temperature: is increasing leaf-nitrogen content an acclimation to lower air temperature?** Weih, M.; Karlsson, P. S. New Phytologist 150(1):147-155. 2001.

191. © **Morphological and physiological reactions of young deciduous trees *(Quercus robur* L., Q. *petraea* [Matt. Liebl., *Fagus sylvatica* L.) to waterlogging.** Schmull, M.; Thomas, F. M. Plant and Soil 225(1-2):227-242. 2000.

192. © **Phenotypic differences between natural and selected populations of *Picea abies*. I. Frost hardiness.** Westin, J.; Sundblad, L. G.; Strand, M.; Hallgren, J. E. Scandinavian Journal of Forest Research 15(5):489-499. 2000.

193. © **Photosynthesis and carbon allocation of six boreal tree species grown in understory and open conditions.** Landhausser, S. M.; Lieffers, V. J. Tree Physiology 21(4):243-250. 2001.

194. © **The phytochromes, a family of red/far-red absorbing photoreceptors.** Fankhauser, C. Journal of Biological Chemistry 276(15):11453-11456. 2001.

195. © **The relation between growth cessation and frost hardening in Scots pines of different origins.** Repo, T.; Zhang, G.; Ryyppo, A.; Rikala, R.; Vuorinen, M. Trees: Structure and Function 14(8):456-464. 2000.

196. © **Relationship between carbohydrate concentration and root growth potential in coniferous seedlings from three climates during cold hardening and dehardening.** Tinus, R. W.; Burr, K. E.; Atzmon, N.; Riov, J. Tree Physiology 20(16):1097-1104. 2000.

197. © **Responses of xylem cavitation, freezing injury and shoot dieback to a simulated winter thaw in yellow birch seedlings growing in different nursery culture regimes.** Zhu, X. B.; Cox, R. M.; Meng, F. R.; Arp, P. A. Forest Ecology and Management 145(3):243253. 2001.

198. © **Seasonal changes in phenological traits and cold hardiness of Fl-populations from plus-trees of *Pinus sylvestris* and *Pinus contorta* of various geographic origins.** Nilsson, J. E. Scandinavian Journal of Forest Research 16(1):7-20. 2001.

199. © **Seed treatment with the antioxidant Abiol enhances membrane protection in seedlings exposed to drought and low temperatures.** Borsos-Matovina, V.; Blake, T. J. Trees: Structure and Function 15(3):163167. 2001.

200. © **Selection of white spruce families in the context of climate change: heat tolerance.** Bigras, F. J. Tree Physiology 20(18):1227-1234. 2000.

201. © **Water stress responses of seedlings of four Mediterranean oak species.** Fotelli, M. N.; Radoglou, K. M.; Constantinidou, H. 1. A. Tree Physiology 20 (16):1065-1075.2000.

Seed

202. © **Aging in *Pinus sylvestris* L. seeds: changes in viability and lipids.** Tammela, P.; Hopia, A.; Hiltunen, R.; Vuorela, H.; Nygren, M. Biochemical Society Transactions 28(6):878-882. 2000.

203. © **Comparative effects of different smoke treatments on germination of Australian native plants.** Lloyd, M. V.; Dixon, K. W.; Sivasithamparam, K. Austral Ecology 25(6):610-61 S. 2000.

204. **Destiny of tree seeds during germination under stress.** Jensen, M.; Westergaard, L. International Plant Propagators' Society, combined proceedings 1999, 49:442-445. 2000.

205. **Ecophysiology of seed germination in *Pinus halepensis* and P. *brutia.*** Thanos, C. A. IN: Ecology, biogeography and management of Pinus halepensis and P. brutia forest ecosystems in the Mediterranean Basin, p. 37-50. Ne'eman, G. and L. Trabaud, eds. Backhuys Publishers. 2000.

206. **Effect of alternate chilling/heating on germination of fresh teak *(Tectona grandis* L.f.) drupes, without scarification of felty mesocarp.** Rajput, A.; Tiwari, K. P. Seed Science and Technology 29(1):57-64. 2001.

207. © **Effect of feeding by the western conifer seed bug, *Leptoglossus occidentalis,* on the major storage reserves of developing seeds and on seedling vigor of Douglas-fir.** Bates, S. L.; Lait, C. G.; Borden, J. H.; Kermode, A. R. Tree Physiology 21(7):481-487. 2001.

208. © **The effects of desiccation on seeds of *Acer saccharinum* and *Aesculus pavia:* recalcitrance in temperate tree seeds.** Connor, K. F.; Bonner, F. T. Trees: Structure and Function 15(3):131-136. 2001.

209. © **Effects of smoke, heat and charred wood on the germination of dormant soil-stored seeds from a *Eucalyptus baxteri* heathy-woodland in Victoria, SE Australia.** Enright, N. J.; Kintrup, A. Austral Ecology 26(2):132-141. 2001.

210. **Fumarase activity as a quick vigour test for Scots pine *(Pinus sylvestris* L.) seeds.** Shen, T. Y.; Oden, P. C. Seed Science and Technology 28(3):825835. 2000.

211. © **Genotype x environment interactions in *Alnus rubra:* developing seed zones and seed-transfer guidelines with spatial statistics and GIS.** Hamann, A.; Koshy, M. P.; Namkoong, G.; Ying, C. C. Forest Ecology and Management 136(1-3):107-119. 2000.

212. **Germination and growth of *Acer* species.** Krautmann, M. E. International Plant Propagators' Society, combined proceedings 1999, 49:595-598. 2000.

213. © **Germination ecology in mountain hemlock *(Tsuga mertensiana* (Bong.) Carr.).** El-Kassaby, Y. A.; Edwards, D. G. W. Forest Ecology and Management 144(1-3):183-188. 2001.

214. © **An increase in pectin methyl esterase activity accompanies dormancy breakage and germination of yellow cedar seeds.** Ren, C.; Kermode, A. R. Plant Physiology 124(1):231-242.2000.

215. **Preparing, patience, and persistence in seed.** Hatch, L. International Plant Propagators' Society, combined proceedings 1999, 49:111-113. 2000.

216. **Presowing treatment of seeds with hydrogen peroxide promotes germination and development of plants.** Narimanov, A. A. Biologia (Bratislava) SS (4):425-428. 2000.

217. © **The relationship between the mitotic activity and moisture content of recalcitrant seeds of *Acer saccharinum* (L.) during maturation, post-maturation drying and germination.** Kozeko, L. E.; Troyan, V. M. Seed Science Research 10(3):225-232. 2000.

218. **Seed crops and seed crop forecasts for a number of tree species.** Hokkanen, T. IN: Forest regeneration in the northern parts of Europe, p. 87-97. Finnish Forest Research Institute, Research Papers 790. 2000.

219. © **Seed dormancy in red rice *(Oryza saliva). XI.* Commercial liquid smoke elicits germination.** Doherty, L. C.; Cohn, M. A. Seed Science Research 10 (4):415-421. 2000.

220. © **Seed production in woodland and isolated trees of *Eucalyptus melliodora* (yellow box, Myrtaceae) in the south western slopes of New South Wales.** Burrows, G. E. Australian Journal of Botany 48 (6):681-685. 2000.

221. © **Storage behavior of *Salix alba* and *Salix matsudana* seeds.** Maroder, H. L.; Prego, I. A.; Facciuto, G. R.; Maldonado, S. B. Annals of Botany 86 (5):1017-1021. 2000.

222. © **Susceptibility of cones and seeds to fungal infection in a pine *(Pinus spp.)* collection.** Vujanovic, V.; St-Arnaud, M.; Neumann, P-J Forest Pathology 30 (6):305-320. 2000.

Soil Management & Growing Media

223. © **Allelopathic bacteria and their impact on higher plants.** Barazani, O.; Friedman, J. Critical Reviews in Microbiology 27(1):41-55. 2001.

224. **Allelopathic interactions in soil.** Lalljee, B.; Facknath, S. IN: Allelopathy in ecological agriculture and forestry, p. 47-58. Kluwer Academic Publishers. 2000.

225. **Coconut-coir-based media versus peat-based media for propagation of woody ornamentals.** Stoven, J.; Kooima, H. International Plant Propagators' Society, combined proceedings 1999, 49:373-374. 2000.

226. **Earthworm-processed organic wastes as components of horticultural potting media for growing marigold and vegetable seedlings.** Atiyeh, R. M.; Edwards, C. A.; Subler, S.; Metzger, J. D. Compost Science and Utilization 8(3):215-223. 2000.

227. **Experience with steam-treated peat.** Kahr, B. International Plant Propagators' Society, combined proceedings 1999, 49:422-423. 2000.

228. **Field B demonstration comparison of grass cover crop, bare fallow, and Dazomet fumigation at J. Herbert Stone Nursery 1997-1999.** Hildebrand, D. M.; Stone, J. K. USDA Forest Service, Pacific Northwest Region, FID Technical Report R6-O1-01. 20 p. 2001. Available at www.fs.fed.us/r6/nr/fid (Click on Publications).

229. **Growing mix component effects.** Jacques, D.; Toops, A. Greenhouse Management and Production 21 (1):59-62, 64. 2001. Find out the impact of growing medium components on plant growth when they are incorporated into a mix.

230. **Putting compost into the mix.** Miller, V. M. The Digger 45(5):33-35. 2001. The nursery industry must define its composting needs so that commercial composters can rise to the challenge.

231. **The role of compost in Oregon nurseries.** Miller, M. The Digger 45(5):36-39, 41. 2001. Interest is high in the organic matter as a soil mix and research continues to improve the final product.

232. © **Soil solution and other soil analyses as indicators of nutrient supply: a review.** Smethurst, P. J. Forest Ecology and Management 138(1-3):397-411 2000.

233. **Spent mushroom substrate as a soil amendment for ornamental plants.** Heuser, C. W.; Holcomb, E. J.; Young, J. International Plant Propagators' Society, combined proceedings 1999, 49:369-372. 2000.

234. **Sustained productivity in intensively managed forest plantations.** Fox, T. R. Forest Ecology and Management 138(1-3):187-202. 2000.

235. **Understanding media - pH management. Part 1: Problems associated with media - pH and solutions for improved pH management.** Argo, B.; Fisher, P. Greenhouse Grower 18(13):42-44, 46, 50, 51. 2000.

236. **Understanding media - pH management. Part 2: Root media and limestone.** Argo, B.; Fisher, P. Greenhouse Grower 18(14):24-26, 29-30. 2000.

237. **Understanding media - pH management. Part 3: Irrigation water alkalinity and its effects on media -pH management.** Argo, B.; Smith, B.; Fisher, P. Greenhouse Grower 19(1):72, 74-76, 78, 80, 82. 2001.

238. **Understanding media - pH management. Part 4: Water-soluble fertilizers and how they play an active role in media - pH management.** Argo, B.; Fisher, P. Greenhouse Grower 19(2):62, 64-66, 68, 70, 72. 2001.

239. **Understanding media - pH management. Part 5: Water soluble fertilizer choices.** Argo, B.; Fisher, P. Greenhouse Grower 19(3):58, 60-62, 64-66. 2001.

240. © **Use of soil solarization to improve growth of eucalyptus forest nursery seedlings in Argentina.** Salerno, M. L; Lori, G. A.; Gimenez, D. O.; Gimenez, J. E.; Beltrano, J. New Forests 20(3):235-248. 2000.

Tropical Forestry & Agroforestry

241. © **Attempting restoration of wet tropical forests in Costa Rica.** Leopold, A. C.; Andrus, R.; Finkeldey, A.; Knowles, D. Forest Ecology and Management 142 (1-3):243-249. 2001.

242. **Bio-economic indicators of enhanced forest nursery and tree plantation establishment operations.** Nasayao, E. E.; Germano, E. M.; Barillo, M. E.; Lumacad, A. M. 1N: International conference on indicators for sustainable forest management, p. 133-134. Held August 24-28, 1998, Melbourne, Australia. 1998.

243. **Desiccation tolerance and storage behavior of neem *(Azadirachta indica* A. Juss.) seeds.** Nayal, J. S.; Thapliyal, R. C.; Rawat, M. M. S.; Phariyal, S. S. Seed Science and Technology 28(3):761-767. 2000.

244. **Effect of seed moisture and drying methods on seed quality of neem *(Azadirachta indica, A. Juss.).*** Karivaradaraju, T. V.; Bharathi, A.; Umarani, R. IN: Azadirachta indica A. Juss, p. 277-283. Singly R.P. and R.C. Saxena, eds. Science Publishers Inc. USA. 1999.

245. **The effects of management regime and host species on sandalwood *(Santalum spicatum)* recruitment near Paynes Find, western Australia.** Brand, J. E. Rangeland Journal 22(2):243-255. 2000.

246. © **The effects of mycofloral infection on the viability and ultrastructure of west-stored recalcitrant seeds of *Avicennia mariana* (Forssk.) Vierh.** Calistru, C.; McLean, M.; Pammenter, N. W.; Berjak, P. Seed Science Research 10(3):341-353. 2000.

247. © **Evaluation of 15 indigenous and introduced species for reforestation and agroforestry in northeastern Mexico.** Foroughbakhch, R.; Hauad, L. A.; Cespedes, A. E.; Ponce, E. E.; Gonzalez, N. Agroforestry Systems 51(3):213-221. 2001.

248. **Genetic differentiation of intrinsic water-use efficiency in the Hawaiian native *Acacia koa.*** Ares, A.; Fownes, J. H.; Sun, W. International Journal of Plant Science 161(6):909-915.2000.

249. © **Influence of seed size on seedling growth of *Albizia procera* under different soil water levels.** Khurana, E.; Singly J. S. Annals of Botany 86(6):1185-1192. 2000.

250. **Neem for reforestation.** Maramorosch, K. 1N: Azadirachta indica A. Juss, p. 11-20. Singly R.P. and R. C. Saxena, eds. Science Publishers Inc. USA. 1999.

251. **Nutrient and carbon dynamics in a replacement series of Eucalyptus and Albizia trees.** Kaye, J. P.; Resh, S. C.; Kaye, M. W.; Chimner, R. A. Ecology 81 (12):3267-3273. 2000.

252. © **Optimizing seedling management: *Pouteria sapota, Diospyros digyna*, and *Cedrela odorata* in a Mexican rainforest.** Ricker, M.; Siebe, C.; Sanchez B.. S.; Shimada, K.; Larson, B. C.; Martinez-Ramos, M.; Montagnini, F. Forest Ecology and Management 139(1-3):63-77. 2000.

253. © **The potential for carbon sequestration through reforestation of abandoned tropical agricultural and pasture lands.** Silver, W. L.; Ostertag, R.; Lugo, A. E. Restoration Ecology 8(4):394407. 2000.

254. © **Symbiotic specificity of tropical tree rhizobia for host legumes.** Bala, A.; Giller, K. E. New Phytologist 149(3):495-507. 2001.

Vegetative Propagation and Tissue Culture

255. **Artificial seed technology application in propagation of forest trees.** Ishii, K.; Maruyama, E.; Kinoshita, I. International Plant Propagators' Society, combined proceedings 1999, 49:647. 2000.

256. © **Effects of IBA and NAA treatments on rooting Douglas-fir stem cuttings.** Copes, D. L.; Mandel, N. L. New Forests 20(3):249-257. 2000.

257. **Forcing environment affects epicormic sprout production from branch segments for vegetative propagation of adult hardwoods.** Van Sambeek, J. W.; Preece, J. E. International Plant Propagators' Society, combined proceedings 1999, 49:399-401. 2000.

258. © **Maturation, topophysis and other factors in relation to rooting in *Larix*.** Peer, K. R.; Greenwood, M. S. Tree Physiology 21(4):267-272. 2001.

259. **Micro-positional differences in cutting origin influence propagation of *Quercus rubra*.** Zaczek, J. J. International Plant Propagators' Society, combined proceedings 1999, 49:361-368. 2000.

260. © **The morphology and seasonal changes in cold hardiness, dormancy intensity and root growth potential of rooted cuttings of Sitka spruce.** Fennessy, J.; O'Reilly, C.; Harper, C. P.; Thompson, D. Forestry 73(5):489-497. 2000.

261. © **Response to auxin changes during maturation-related loss of adventitious rooting competence in lobol1y pine (*Pinus taeda*) stem cuttings.** Greenwood, M. S.; Cui, X.; Xu, F. Physiologia Plantarum 111(3):373-380. 2001.

262. **A review of the propagation of *Pinus radiata* by cuttings, with emphasis on juvenility.** Thomas, M. B.; Spurway, M. I. International Plant Propagators' Society, combined proceedings 1999, 49:103-106. 2000.

263. **The role of vegetative propagation in CSIRO Forestry and Forest Products.** Hartney, V. International Plant Propagators' Society, combined proceedings 1999, 49:139-144. 2000.

264. **Rooted cuttings for southern pines.** Stelzer, H.; Goldfarb, B. International Plant Propagators' Society, combined proceedings 1999, 49:506-509. 2000.

265. **Setting up a small-scale micropropagation lab.** Woodske, D. International Plant Propagators' Society, combined proceedings 1999, 49:598-601. 2000.

266. **A taxing taxon.** Bassuk, N. L. American Nurseryman 193(1):30-31. 2001. Oaks are difficult to propagate vegetatively, but one stooling method has achieved some success.

267. **The use of second generation cuttings to increase the rooting and quality of micropropagated elms.** McCown, D. D. International Plant Propagators' Society, combined proceedings 1999, 49:379-381. 2000.

268. **Using subirrigation to root stem cuttings: a project review.** Regan, R.; Henderson, A. International Plant Propagators' Society, combined proceedings 1999, 49:637-644. 2000.

Water Management

269. **Ability of restored wetlands to reduce nitrogen and phosphorus concentrations in agricultural drainage water.** Woltemade, C. J. Journal of Soil and Water Conservation 55(3):303-309. 2000.

270. **Are nutrient plans necessary?** Ross, D. S.; Lea-Cox, J. D.; Teffeau, K. M. Nursery Management and Production 17(4):35-36, 38, 40. 2001. These strategies can help your nursery with governmental compliance and help you save money. 271. Biological filtration shows promise for treating water. Berghage, R. Greenhouse Management and Production 21(4):68, 70, 71. 2001.

272. **Effect of water quality of plant propagation.** Mathers, H. International Plant Propagators' Society, combined proceedings 1999, 49:535-540. 2000.

273. **Erosion remedy.** Richards, D. American Nurseryman 193(3):24-26, 28-29. 2001. Growers can employ bioremediation strategies to help prevent soil erosion and water pollution.

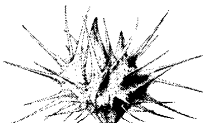
274. **Fertilizer for subirrigation.** Pennisi, B. V.; Kang, J. G.; van Iersel, M. Greenhouse Management and Production 21(2):18-21. 2001.

275. **Flood floors: the hidden benefits.** Neumann, C. Greenhouse Management and Production 21(3):30-34. 2001.

276. © **Pilot plant for reclaimed wastewater reuse in nurseries.** Gori, R.; Lubello, C. Water Science and Technology 42(1-2):221-226. 2000.

277. **Recycling of water in a seedling nursery.** Kruger, M. International Plant Propagators' Society, combined proceedings 1999, 49:72-75. 2000.

278. **Subirrigation: irrigation with a twist.** Pennisi, B. V.; James, E. C.; Van Iersel, M. Greenhouse Grower 19 (3):22, 24, 26, 28. 2001.



Weed Control

279. **Activator adjuvants.** Penner, D. Weed Technology 14(4):785-791.2000.

280. **Adjuvant trends for the new millennium.** Underwood, A. K. Weed Technology 14(4):765-772. 2000.

281. Adjuvants - terminology, classification, and chemistry. Hazen, J. L. Weed Technology 14(4):773-784. 2000.

282. © **Assessment of the effect of broad-spectrum pre-emergence herbicides in poplar nurseries.** Sixto, H.; Grau, J. M.; Garcia-Baudin, J. M. Crop Protection 20(2):121-126. 2000.
283. Corn gluten meal - a natural preemergence herbicide: effect on vegetable seedling survival and weed cover. McDade, M. C.; Christians, N. E. American Journal of Alternative Agriculture 15(4):189-191. 2000.

284. **Extension perspective on grower confusion in adjuvant selection.** Zollinger, R. K. Weed Technology 14(4):814-818. 2000.

285. **The influence of elevated carbon dioxide and water availability on herbaceous weed development and growth of transplanted loblolly pine.** Gavazzi, M.; Seder, J.; Aust, W.; Zedaker, S. Environmental and Experimental Botany 44(3):185-194. 2000.

286. **Interaction of surfactants with plant cuticles.** Hess, F. D.; Foy, C. L. Weed Technology 14(4):807813. 2000.

287. **Mother knows best: Meadowfoam seedmeal shows promise as an organic alternative to fertilizers, pesticides.** Stanley, H. The Digger 45(3):48-53. 2001. Meadowfoam seedmeal seems to suppress growth of liverworts.

288. **Physiochemical properties of adjuvants: values and applications.** Stock, D.; Briggs, G. Weed Technology 14(4):798-806. 2000.

289. **Using noxious weed lists to prioritize targets for developing weed management strategies.** Skinner, K.; Smith, L.; Rice, P. Weed Science 48:640-644. 2000. A database of noxious weed lists is available at < http://invader.dbs.umt.edu >

290. **Utility adjuvants.** McMullan, P. M. Weed Technology 14(4):792-797.2000.

291. **What makes a weed a weed?** Miller, L. International Plant Propagators' Society, combined proceedings 1999, 49:190-191. 2000. Features possessed by the ideal weed include high seed production, easily dispersed seed, long seed dormancy, rapid growth rates, climbing habit, vegetative reproduction, tolerance to chemicals, high ornamental value, and ability to repel predators or grazing animals.

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Your Nursery:

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