ment, and total root production was about the same tinder both conditions.

Restraint of roots by the copper screen significantly improved survival with all ages of loblolly seedlings (table 1). Seedlings grown on copper screen had a survival rate of 86 percent; only 63 percent of those grown without the screen survived.

A significant interaction between the copper screen treatment and seedling age occurred with longleaf pine. The survival rate of 4-month-old seedlings was 18 percentage points higher for those grown on copper screen than for those grown without it. At the other ages, copper screen had no effect. Apparently, this species reacts differently from loblolly because the slow height growth of longleaf pine places less moisture stress on these seedlings.

The copper screen treatment did not affect field growth of either species.

These results indicate that root pruning with copper screen improves seedling survival.

Literature Cited

1. Saul. G. 11. 1968. Copper safely controls roots of tubed seedlings. USDA Forest Serv. Tree Plant. Notes 19(1): 7-9.

News and Reviews

Seed X-ray Symposium-Workshop

A one-day symposium followed by a three-day workshop on seed radiography will be held November 4-7, 1974 at Macon, Ga. The symposium papers are authored by specialists in their field and will provide the latest information available.

The workshop will encompass the field of radiography-everything from theory to use. This program will be beneficial to both those using x-ray and those who have not used x-ray but would like to use it. Much modern equipment will be available for instruction and use, including the latest technique of instant x-ray.

Tours will also be available to tree nurseries, seed cleaning plants. seed testing laboratories and seed orchards. Consideration will also be given to particular requests.

Programs will be available March 1. For further information and a copy of the program write:

Dr. Earl W. Belcher, Jr.
Eastern Seed Laboratory
P.O. Box 819
Macon, Georgia 31202 U.S.A.

Attendance will be limited and a small registration fee will be charged.

Drainage May Increase Growth Of Slash Pines On Wet Flatwood Sites

Two recent research projects - one in Georgia and the other in Florida - show that growth rate of young slash pines increased after drainage of sandy soil sites. Union Camp Corporation's Woodlands Research Department found that trees up to 200 feet away from secondary shallow canals experienced a three-year height growth 2.5 times that of trees in undrained areas ... the experiment was with seven-year-old slash pine plantation in McIntosh and Lon Counties, Georgia ... location was Snuffbox Swamp. More information is available on this study from Barry Malac, Woodlands Research Director, Union Camp Corporation, Savannah, Ga.

The Florida study was conducted by the Southeastern Forest Experiment Station on the Apalachicola National Forest at the headwaters of Fort Gadsden Creek. At the time of drainage, site index averaged 50 and stand age averaged 19 years ... ten years after drainage, trees "were growing at a rate comparable to that of trees of the same age growing on a site index of 80-85 (15 to 16 feet in 10 years)." Results are reported in SE-186 by Cortland E. Young. Jr. and R. H. Brendemuehl, available from Southeastern Forest Experiment Station, P. 0. Box 2570. Ashesille. N. C. 28802.

What's the message? For one thing, the two studies reveal that growth increase resulting from drainage lessens with age of the treated stand.

Important note: Wet flatwood sites vary widely in their potential site indexes, as borne out by a recent study for the Southeastern Area office by Ralph A. Klawitter, Keith K. Young and James M. Case. No increase in pine growth can be expected from certain sites after drainage ... each case is different and management decisions must be made on the basis of soil type, thickness of soil layers and many other factors. Consult a soil scientist of the Soil Conservation Service before taking any action. Meanwhile, you might want to read "Potential Site Index for West Pineland Soils of the Coastal Plain", which reports results of Klawitter's study. Copies are available from Southeastern Area, State and Private Forestry, 1720 Peachtree Road, N.W., Atlanta, Ga. 30309.

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TABLE 3.—*Morphological features of average 3-year-old red pine seedlings following 1-year growth on performance test plots*

Depth to Water table	Length		Stem diameter	Weight		Top-root ratio	Mycorrhizal short roots
	Tops	Roots		Tops	Roots		
Inches	*Cm.*		*Mm.*	*G.*			
			Control cultures				
30	24.0	21.1	2.7	2.50	1.02	2.4	Ample
18	24.0	19.1	2.9	3.51	1.34	2.6	Abundant
6	19.8	14.5	1.6	1.30	0.54	2.4	Sparse
			Maneb sprays at weekly rate of 12 lbs/a				
30	24.0	17.6	2.4	2.96	1.26	2.3	Abundant
18	26.4	23.6	2.8	4.04	1.77	2.3	Abundant
6	17.6	18.5	2.3	2.22	1.08	2.0	Ample
			Maneb sprays at weekly rate of 24 lbs/a				
30	23.8	18.4	2.6	3.36	1.33	2.5	Abundant
18	24.8	18.8	2.4	3.38	1.12	3.0	Abundant
6	15.3	12.3	1.5	0.87	0.27	3.2	Sparse
			Two direct applications of manganous sulfate of 200 lbs/a each				
30	22.0	21.2	2.1	2.16	0.85	2.5	Abundant
18	21.5	22.0	2.2	1.93	0.62	3.1	Abundant
6	----------			No survival		----------	

News 8 Reviews

(Continued from p. 12)

Symposium on Containerized Tree Seedlings

New developments in a better way of growing forest tree seedlings will be the subject of a symposium in Denver, Colo., Aug. 26-29. 1974.

The North American Containerized Forest Tree Seedling Symposium, sponsored by the Great Plains Agricultural Council and several national forestry groups of the U.S., and Canada. will bring together specialists in this seedling production process from both countries to present information on latest developments and techniques.

More on Radiographs

After reading the article 'New techniques for reading seed radiographs save time" (in TPN 24(3), p. 14). D. G. Edwards of the Canadian Forestry Service, Pacific Forest Research Centre, Victoria, B. C., writes that his laboratory uses a frame similar to that described by Professor Duffield. His description follows:

"We stretch a sheet of adhesive film, such as the decorator vinyl coverings sold in hardware stores, on the underside (sticky side up). The clear, transparent type of film is used. When the radiograph has been developed, the trayplus-seeds can he placed directly on top of the x-ray negative and the seeds and their images matched up. Illumination from below, by means of a light table, facilitates this.

Individual seeds showing particular characteristics can he identified on the radiograph by circling with a felt-tipped pen or chinagraph pencil. With the transparent film base of the tray. the markings on the radiograph can easily be seen on the light table and the respective seeds identified. For very small seeds, and where the seeds are tightly packed on the tray, we find that staggering the seeds slightly to one side, rather than precisely lining them up with their images, permits easier viewing of the markings on the radiograph.

This method has been used in this laboratory for several years and offers two additional advantages: 1) It can be used by personnel who have difficulty using a stereoscope and, 2) it avoids the $150-200 outlay for the stereoscope or drafting machine. The method works on all sizes of x-ray film: we routinely use an 8" x 10" tray and matching film. It can also be used with Polaroid prints and the new radiographic paper (Kodak). The key is the transparent adhesive film forming the base of the tray."

Nobel Prize Winner Talks of Forestry

Dr. Norman E. Borlaug. winner of the 1970 Nobel Peace Prize for his work in developing high yield varieties of wheat, took a week-long tour of national Forests in Idaho, Eastern Oregon, and Montana last fall. In a Montana talk, Dr. Borlaug praised the success of Forest Service researchers - developing a disease resistant strain of the Western White Pine Tree - and noted that U.S. forestry in general is a leader in world research and management.

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TABLE 4.—*Germination characteristics of 500 pre-chilled red maple seeds, 50 from each of 10 trees*

Tree No.	Germination capacity			Viable seeds germinating in 10 days
	10 days	15 days	35 days	
	Percent			*Percent*
1	92	92	92	100
2	82	82	82	100
3	56	64	66	85
4	78	82	84	93
5	74	82	82	82
6	68	76	78	87
7	54	56	56	96
8	36	42	42	86
9	74	84	86	86
10	48	56	56	86
Averages	66	72	72	90

trees gave an average germination capacity of 73 percent and a germination energy period of 10 days. Treatment by pre-chilling did not improve germination, which suggests that fully ripened red maple seeds possess little if any dormancy in the Northeastern region.

News Et Reviews

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Aerial Seeder Wins Award

An aerial row seeder developed at Auburn University in cooperation with the Southern Forest Experiment Station has been cited as one of the 100 most significant new technical products designed during the past year.

With the device, approximately 9,000 pine seeds per minute can he planted from a helicopter or airplane. In contrast, an experienced planter working long hours would do well to plant 2,000 seedlings in a day.

The award was presented in Chicago by INDUSTRIAL RESEARCH magazine to Dr. M. A. Cutchins. associate professor of aerospace engineering at Auburn, who designed the seeder under a research grant sponsored by the USDA Forest Service and the Southern Station.

An advisor board of INDUSTRIAL RESEARCH selected the winning products for their importance, uniqueness, and usefulness from a technical standpoint. On the hoard are Wernher von Braun and more than 20 other distinguished scientists.

(From Forest Research News for the MidSouth, SO Station)

Championship Pine on Sierra

The Minarets Ranger District, Sierra National Forest, is the proud home of the National Champion ponderosa Pine tree.

Skip Sevedge, District Silviculture Assistant, early this summer discovered what appeared to be an extremely large ponderosa pine. Skip, and Charlie Sells, forestry technician went back to the tree to make accurate measurements and take pictures. They submitted the information to the American Forestry Association for their review.

In October, the Association confirmed that Skip's tree is the new National Champion. The Minarets Pine measures 22 feet 2 inches in circumference, and 236 feet high. It has an average crown spread of 51 feet. Total points for their new champion is 515.5. compared to 507 points for the listed champion in Oregon.

The discovery of this tree is significant, since the ponderosa pine species has a very wide distribution throughout western North America. The Minarets District plans to take steps next season to protect the tree and make it a point of public interest.

The Case Of The Crippled

In recent years, pronounced needle tip burn" and subsequent death of trees in three southern Appalachian white pine seed sources were noted at the Beech Creek Seed Orchard in western North Carolina. The problem was investigated by C. E. Cordell and W. II. Sites of the Southeastern Area and Edwin II. Manchester of the National Forests iii North Carolina. Their conclusions: "all evidence to date points to air pollutants - sulfur dioxide or ozone. for example-as tile most probable cause. "Where does the pollutant come from? No one is sure at this time. For more information, write for copy of Report No. 74-1-9 to Southeastern Area, State and Private Forestry. 1720 Peachtree Road. N. W. .. Atlanta, Ga. 30309.

(From "Forest-Grain South". SA-S & PF)

(Continued on p. 29)

cent resulted in 82 percent germinability and GV of 29.1, but a moisture level of 25 percent at the same temperature in maintained 90 percent viability with GV of 40.9. It is obvious, then, that imbibed seeds are sensitive to variations in storage conditions.

At 5 percent moisture content, only the 2° temperature, and at 15 percent moisture only the 2° and -7° temperatures resulted in reduced germ inability (table 1). At these moisture contents temperatures of -15 and -23° maintained both speed and completeness of termination equal to that in the initial tests. The poorer performance at 2° and negative 7° is probably related to the development of secondary dormancy. This phenomenon occurs in loblolly pine seed held under certain conditions of moisture and storage temperature (3).

These data indicate that loblolly pine seeds with high moisture contents, as attained during stratification, must be handled carefully if stored without drying. Care should he taken to avoid extremely low temperatures (near -23°C) and those above freezing. Even in a range of -15° to -7°, seeds may he promoted to the extent that they begin to germinate in storage or that dormancy is reinduced. For this reason, large lots representing a considerable investment should be dried before storage. Some reinduced dormancy must be expected, particularly if seeds are dried only to 10 to 18 percent moisture and stored at temperatures near freezing (1). Therefore, drying to 7 to 10 percent moisture and staring at subfreezing temperatures are recommended.

Literature Cited

1. Barnett, J.P. 1972. Drying and storing stratified loblolly pine seeds reinduces dormancy. USDA Forest Serv. Tree Planters' Notes 23(3): 10-11.
2. **Czabator, F.J. 1962 Germination value: an index combining speed and completeness of pine seed germination. For. Sci. 8:386-396.**
3. **McLemore, B.F. and J.P. Barnett. 1968. Moisture content influences dormancy of stored loblolly pine seed. For. Sci. 14:219-221.**

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Dying Forest Helps in Radiation Probe

For the past 12 years an isolated forest area at New Turk's Brookhayen National Laboratory has brew dying a slow, deliberate death, The forest, an experimental victim of the atomic age, is bring devastated by lethal gamma rays. much the same as might happen during fallout from a nuclear holocaust.

But the *Irradiated Forest,* as it is called, is offering Brookhayen scientists more than just a chilling look at the long-teen effects of radiation. It also is giving them a better understanding of how a forest grows and what happens to it under stress.

*There is some evidence that the pat*terns of destruction are similar. whether the stress comes from radiation or from air pollution, pesticides or other toxic substances.

Within 6 months after a radiation source was placed at the center of the forest, all higher plant life within 20 yards of the source was killed. Since those first months, distinct zones of destruction have been radiating slowly outward from tile source.

In the zone closest to the source, where radiation intensity is highest• only the most primitive lichens survive. In the zone at the perimeter of the 50-acre forest all forest species survive. but not without some ill effects.

"You see the changes in the forest telescoped here in a relatively short period of time," George M. Woodwell. the project's senior ecologist. said recently as he prepared to enter the forest. "If you disturb vegetation chronically (even by means other than radiation) you will find patterns similar to this,"

On a recent afternoon, Woodwell entered the well-fenced forest arid started walking down a narrow dirt path toward the forest's center. Through a small clearing at the end of the pat li. the bleached remains of trees were already visible.

But at the forest's perimeter, there were no visible signs of radiation damage. The five major types of vegetation common to Long Island forests were present-pines, oaks, hushes, grasses and flosses.

Only Woodwell's practiced eve could pick out the first subtle effects of the radiation. Alter he had walked only a short distance, he paused. "Even here," he said, "I'm sure I can measure effects on the pine trees ,,.the needles are shorter, the diameter of the trees is reduced."

He was about 160 yards from the radiation source, as measured by small stones placed along the pathway. At this point, less than one roentgen a day of radiation was reaching the vegetation. As wood well continued his walk he started clicking off an increasing inventory of death and destruction.

"At 130 yards, there are definitely measurable effects-I to 2 roentgens' exposure per day," Woodwell said, lie pointed to scraggly, Blunted pine trees with many of their branches hart' of needles. But the oak trees looked healthy and the ground cover of shrubs and grasses was abundant. The forest still looked pretty healthy.

Yet just 10 yards later, Woodwell said simply, "We've now lost the pine trees." At 125 yards from the radiation source• we had entered another vegetation zone, a zone in which no trine trees survived. "We now have just an oak forest." Woodwell "aid.

"As we keep walking, we'll start In take out the scarlet oak and the white oak,"

Woodwell now was into the devastated clearing at the forest's center, an area in which the destruction hooks as if it could have been caused by a 750-pound bomb. At about 100 yards from the source (about 1o roentgens' exposure a day), the oaks have disappeared. Only small seedlings survive closer in, and they soon die off.

At 80 yards (between 10 and 20 roentgens' exposure a day), the blueberry arid huckberry bushes have disappeared. At 22 yards (about 160

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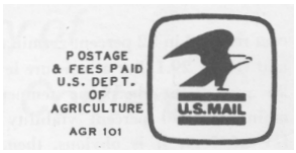

roentgens a day), the grasses and sedges have dropped out. Only primitive organisms called crustos, lichens and some green algae survive in the shadow of the pole on which the radiation source is placed.

The remains of trees killed during the early months and years of the experiment are still scattered about this central clearing, and there are no greens or browns in this zone, only' the gray, bleached remains of trees that once were 40 to 50 feet high. It is a nuclear graveyard, offering a glimpse at a possible future with an impact more telling than any science-fiction novel or movie.

Woodwell and his colleagues, however, are not concerned with science fiction. The succession of death that Woodwell clicked off appears to be almost a reverse of the succession of life that is common in the growth of a forest.

The Brookhaven study- has been helping to give ecologists a more precise look at what might he called the architecture of a forest-the way it is put together.

If a hare field is simply abandoned, the weeds take over first, then the crabgrasses, later the grasses, then the pine trees and, finally, in a hundred years or so, the oak trees.

The irradiated forest has been allowing scientists to track the succession back the other way, to see which species deteriorate first: to study what happens to the insects and which vegetation becomes most vulnerable to their attack.

(From a report in The Washington Post. Feb. 18., 1974)

New Books

Forest Service. U.S. Department of Agriculture.

1974. Seeds of woody plants. .Agric. Handb. 450, illus. This book contains principles and general methods of producing, handling. and germinating seeds of trees and shrubs with detailed data on 187 genera. Supersedes the old standby. "V. (Holy Plant Seed Manual...

New Publications

Dodson, Benny

1974. Tree farming is good business. *In Soil Conservation* Vol. 39 (6) p. 20-21. Small timber tracts, when properly managed, can still make money. A farmer in Fast Feliciana Parish, La. tells how his tract was handled with the help of the Soil Conservation Service and the Feliciana Soil and Water Conservation district who soil mapped the property and provided needed advice. As a result, this 40-acre tract has yielded an annual return of more than $20 per acre for the past 17 years.

Cochran, P. H. and Carl M. Bernsten

1973. Tolerance of lodgepole and ponderosa pine seedlings to low night temperatures. *Forest Sci*. 19(4): 272-280 (December 1973)

Mortality of ponderosa pine (Pinus *Ponderosa* Laws.) seedlings less than 36 days old was greater than that of similar aged lodgepole pine *(Pinus contorta* Dougl.) When exposed to night minimums lower than 23° F ill a growth chamber. Thirty-six-day-old seedlings of both species were more susceptible to mortality from exposure to a low night temperature of 18° F than seedlings 22-day-old. Previous exposure to temperatures just above freezing reduced mortality of both species when they were exposed to night minimums of 20° F or less. Exposures ,3 days apart to minimums of 15° and 14° F increased mortality for both species. At 2 Month, species differences in relative tolerance to low night temperatures had disappeared. Further. seedlings of both species which were germinated in late spring and raised until fall both in the greenhouse under natural photo-periods as well as outdoors is withstood night minimums down to 15° F. Seedlings raised outdoors were only slightly more tolerant. indicating that photoperiod is more important titan low temperature preconditioning in development of fall hardinessfor thesesleeks.

Price Vincent J.

1973. Soil interpretations for environmental forestry. Soil Conservation Vol. 39(4), p. 8-10. (November)

Environmental forestry is a growing topic of public interest. Farmers want trees for windbreaks and wildlife habitat, cities and towns want there for streets and parks, and homeowners like ornamental trees around their horses. The capabilities and limitations of their soils will make a difference to all of these interests in the use of trees. Important factors in determining which trees to plant in a particular area are soil drainage, soil texture. depth to bedrock, and soil chemistry. Site study teams of SCS now often include interpretations for environmental forestry in their soil survey data. There are plans to make these interpretations available to anyone who needs the information.