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- Thrives when close-cut

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# CRYSTAL

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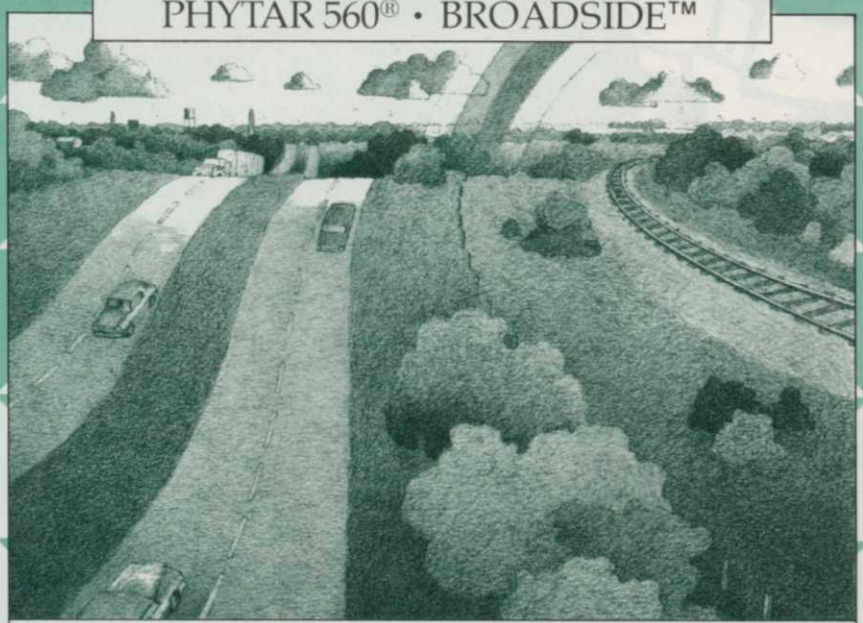

## GENERAL NON-SELECTIVE HERBICIDES

For general post-emergent weed control in non-crop areas Crystal Chemical Company makes Phytar 560 and Broadside. Both are Cacodylic Acid type herbicides, and Broadside also contains MSMA. Both products can be used for fast knockdown of weeds along highways, rights-of-way, around buildings, fence rows, playgrounds, drainage ditches, golf courses, and railways. Phytar 560 is safe for use around ornamentals and non-bearing citrus orchards, while Broadside's effective root-kill is ideal for controlling tough perennials. Both provide complete weed control without soil sterility. So don't let unsightly and hazardous weeds control you. Control them with Phytar 560 or Broadside.


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**Tree Diseases** *from page 20*

make without excess sodium is 8.3). When the high pH is noted, tests for sodium are in order. The alkali pool is commonly referred to as "black alkali"; the soil structure collapses into a gummy mass which adds physical problems to the chemical toxicity of the soil (Longenecker and Lyerly 1974, Richards 1954, and Barber 1964). A forest soils text (Wilde 1946) says that soils with pH's 8.1-8.5 are toxic to trees and cause dwarfing, and that trees can not grow in soils with a pH above 8.5.

### Control of watering injuries

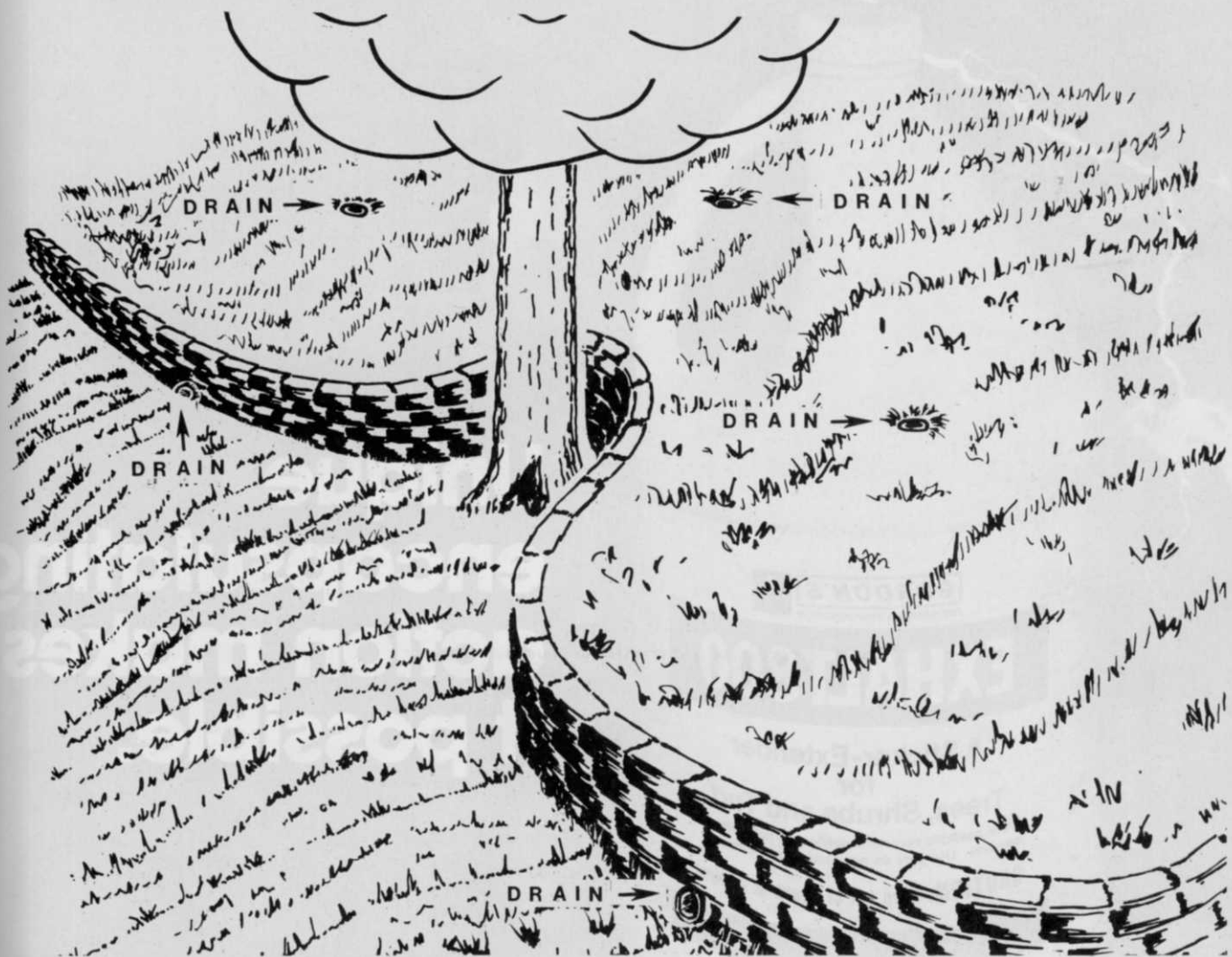
To control root smothering and salt from the irrigation of lawns, water no more often than once a week (every 10 or 12 days is better). Water at each setting to equal about 2 inches of rain, until there is run-off; the run-off insures the flushing out of any salt that has built up on the surface from evaporation. Mulches on the soil surface (gravel, pine bark, composted leaves, etc.) help reduce evaporation from the soil surface and should reduce water use. The less water used, the less salt is left behind as the water evaporates from the soil surface or the leaves. Allowing the soil to dry between each watering prevents root suffocation. A neighbor of mine in Bryan only waters two or three times a year, and sometimes less often; his grass is usually brown, but his trees are the healthiest in the neighborhood.

In more arid climates where watering must be done because trees can not survive without artificial watering, gypsum ($CaSO_4$) can be added to the soil. The sulfate neutralizes the alkali from the sodium. Sulfur can also be added to get the same effect, but the amount of water soluble salts in the soil can continue to build up and eventually give you salinity problems. Watering once every three weeks should keep live oaks and post oaks healthy. All fertilizers (in areas where water is high in sodium) should be in the form of sulfates. Fertilizer salts also add to the total salinity; therefore, fertilizer use should be restricted.

### Excess Fertilizer

Fertilizing grass lawns to a lush green with more than 1,000 pounds of fertilizer per-acre-per-year,

*Continues on page 26*




**Open dry well** at edge of filled slope provides air and water circulation to the area covered with fill. The wall should be a few inches higher than the fill to prevent debris from washing into the well.

# With Exhalt® 800 78% of your fungicide is still working even after a 2-inch rain...


# Unique encapsulating action makes it possible.

## Percentage of fungicide retained after rains, Exhalt 800 versus Brand X:

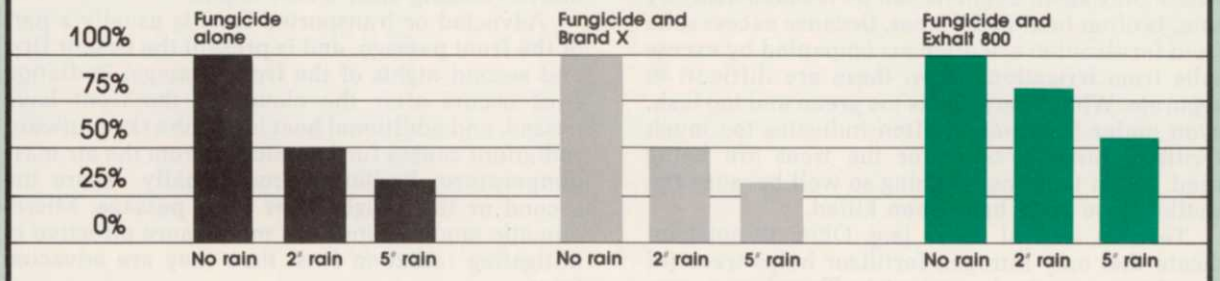



Chart shows how Exhalt 800 resisted wash-off in a laboratory test. Spray coatings were applied to glass panels and dried 10 minutes at approximately 70° F. Retention after erosion by rain was measured by solvent stripping the panels and determining the residual fungicide by quantitative ultraviolet spectroscopy.

# See how Exhalt 800's encapsulating action guards against costly fungicide wash-off:

**This test with Exhalt 800 shows 78% of fungicide was still intact after a 2-inch rain. Even after 5 inches of moisture, 60% was still in place.**

We're painfully aware that you may be disenchanted with spreader-stickers, so we want to emphasize that Exhalt 800 is *not* a spreader-sticker. Rather it is a *Sticker-Extender*, and there's a world of difference!

The *spreader* part of a spreader-sticker is a detergent that actually assists in wash-off. Exhalt 800, on the other hand, has a unique encapsulating action that causes fungicide to *resist* wash-off.

Simply stated: Spreader-Stickers *assist* wash-off; Exhalt 800, a unique Sticker-Extender, *resists* wash-off.

### Defies Rain

To illustrate its clinging power, let's suppose you have added Exhalt 800 to your fungicide and treated 18 greens. An hour later a dark, menacing cloud rolls in; in the next 45 minutes it dumps two inches of rain on your treated greens. What now?

Obviously, some of your treatment is washed away. But the silver lining is . . . *some 78% of it is still in place and working.* Thanks to Exhalt 800's unique encapsulating power, you won't have to repeat the whole costly process again tomorrow.

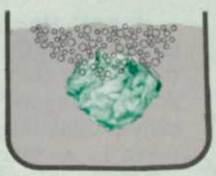
Even in arid regions plagued with occasional fungus flare-up, Exhalt 800 pays. It lets you spray and, after an hour, irrigate. With no more worry about losing your greens to either fungus or drought.

### The Exhalt 800 difference

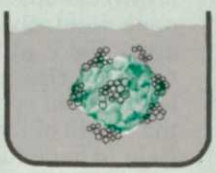
Unlike spreader-stickers that wash off with the first rain, Exhalt 800 (a sticker-extender) clings with encapsulating power. It's an extremely sticky, flexible, fabric-like protector that encases every fungicide particle, keeping it in place and working despite rainfall.

### A closer look at Exhalt 800's unique encapsulating action:

One miniscule fungicide particle, greatly magnified. Countless millions of such particles in water become the spray solution.



Exhalt 800 enters spray tank. Hydrophobic (repelled by water), it breaks into myriad of tiny droplets and attaches to fungicide.



Tiny Exhalt 800 droplets form a porous "fabric" that encapsulates every fungicide particle, causing it to cling to turf or foliage.

To get a clear picture of Exhalt 800's superiority, study the chart above. This test, important though it is, is just one of many. Our files hold much other massive evidence of Exhalt 800's unique encapsulating power: the field-test data from many leading universities (test results available on request).

While Exhalt 800 is used extensively on turf, it also is registered for use with insecticides for trees and ornamental shrubs. In every use, it lets plants "breathe," grow and develop normally. It's economical and easy to use.

Exhalt 800 is effective with most brands of wettable-powder and flowable fungicides, including Gordon's Dymec 50™, Formec 80™, and Topmec 70W™.

### Try Exhalt 800 now

The evidence is clear and overwhelming — Exhalt 800 doesn't cost, it pays. Don't you owe it to yourself and your greens committees to give it a trial? One gallon will prove it to you. If your distributor doesn't have Exhalt 800, or if he's out of reach, order a trial gallon direct from us. Send a check for $28, we'll rush a gallon postpaid. *Send to PBI/GORDON Corporation, P.O. Box 2276, Kansas City, Kansas 66110.*

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on claypan or caliche soils in semi-arid areas where only small amounts can be leached away by rain, is often fatal to the trees. Because excess salts from fertilization are often accompanied by excess salts from irrigation water, these are difficult to separate. Where the grass is too green and too lush, even under the trees, it often indicates too much fertilizer (and/or salts) for the trees are being used. Often the grass is doing so well because the shallow tree roots have been killed.

Tests in several states (e.g. Ohio, Illinois) indicate that only nitrogen fertilizer helps trees (of the three principal nutrients). Phosphorus may help rooting on new transplants, and phosphorus may increase flowering. However, woody plants through their mycorrhizae can absorb phosphorus not available to crop plants, and its lack does not limit tree growth. Almost all Texas soils have an excess of potassium. It should not be added.

As a general rule, fertilizer applications should not exceed 435 lb./acre/year, or 10 lb./1,000 sq. ft./yr.

#### Deficiencies

In alkaline soils zinc and iron may be deficient in the trees even with an adequate supply in the soil. They may have to be added by foliar sprays to the trees. Foliage sprays of ½ percent solutions of iron and zinc sulphate can make the trees greener.

Trees in the Gulf coastal plains soils can increase growth and leaf retention by adding magnesium. Foliage sprays of ½ percent $MgSO_4$ turn yellowish trees green, but trees so treated showed remarkable increases in growth when serpentine gravel was spread around their bases when compared to trees without the serpentine ($Mg_3Si_2O_7 \cdot 2\ H_2O$);(in Bryan). Dolomite gravel should also be effective. These soils in Bryan do not show Mg deficiency in the soil tests, but the addition of magnesium gives improved color and improved growth in perennial woody plants.

#### Damaging Weather

Abnormal weather often harms vegetation. Through cultivation we extend the ranges of plants into regions where normal weather has adverse effects. This cultivation makes our plants more susceptible to weather.

#### Frost

Frost is usually associated with the passage of cold fronts in the continental United States. The cold front is the leading edge of a mass of cold air advancing into a warmer region. Most of these air masses are Polar, Continental air advancing into areas that average warmer. (In America we tend to consider frost a temporary condition, and a freeze the more permanent; in Europe, frost is used in the more permanent and colder sense we would call a freeze.) These temporary chillings occur in the summer in the Lake States, in winter in the Gulf coastal plain, and in the spring and fall in the intermediate latitudes.

These cold air intrusions cannot persist in the warmer heat balance, so the temperature is usually above freezing after a few nights.

Advected or transported frost is usually a part of the front passage, and is present the first or first and second nights of the front passage. Radiation frost occurs after the clouds of the front have passed, and additional heat loss to the sky (outward radiation) causes further cooling from the air mass temperature. Radiation frost usually occurs the second or third night after front passage. Microclimatic modifications are much more effective in mitigating radiation frost than they are advected frost.

#### Advected frost

In a forested region, nocturnal winds are much reduced by the roughness of the surface. The trees tend to protect against cold wind, and the heat stored in the tree bodies reradiates and tends to keep the trunk space (beneath the canopy) climate relatively warm. Therefore, the forest stand does protect against advected frost.

#### Radiation Frost

The trees are more effective as protectors against radiation frost (that frost produced by radiated heat loss on clear dry nights). In the northern hardwoods the temperature averages about 10°F warmer than in open field, but it may be as much as 15° warmer on a clear cold night.

In an oak stand in southern Wisconsin that I studied for three years, frost occurred 30-45 days later under the leaf canopy than it did in the open. In fact, it never frosted under the canopy until the trees were defoliated (Van Arsdel et al 1961).

Buildings are as good as trees at protecting against frost, heated buildings are better. Plants in courtyards or close to buildings receive protection from frost. The D:H ratios apply as well as they do in the forest.

#### Forest Openings

Forest trees greatly modify the local climate. Openings in the forest have special characteristics that make them helpful in preventing local frost. An opening with a diameter from crown edge to crown edge less than the height of the surrounding trees is as warm at night as under an unbroken crown canopy. This is from 1-5°C. warmer than an open field. By day it is probably cooler than an open field, although size and time of day have more precise effects on daytime temperatures. A larger sized opening, i.e. four times the diameter of the height of the trees, is about as likely as the open field to have radiation frost. Larger sized openings are more likely to have frost, smaller sized openings are less likely to have frost (Van Arsdel 1972).

#### Topographic effects

Topography has a major influence on radiation frost. Cold air flows downhill in layered flows at night something like water (with extra friction). Low places such as kettle holes fill with cold air, as do valleys. Cold air pools are often found at the

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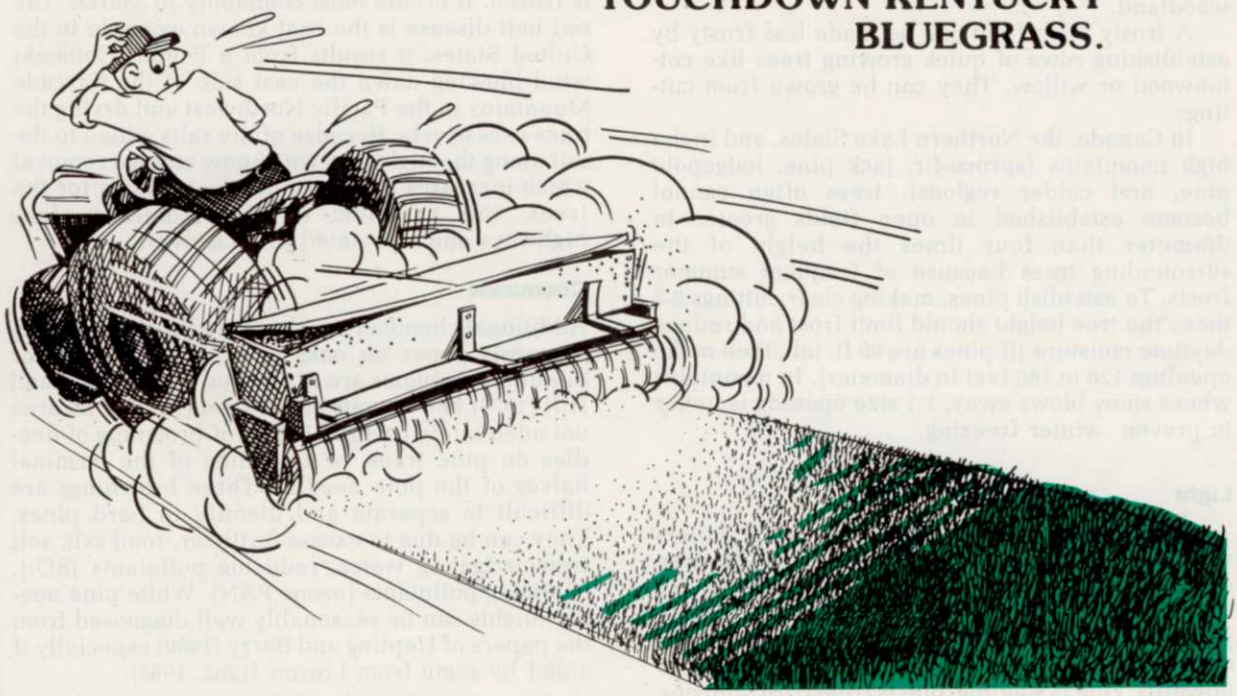

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bases of slopes or, on gentle slopes, on the uphill side of obstructions that make air dams. The cold air pools in valleys often turn into down valley winds, as the night progresses in mountainous or hill country.

### Frost Control

Frost can be avoided in plantations by locating young trees on warm shoulders. After these trees have grown up it is possible to advance your forest edge from the established trees as the frost danger is reduced at the crown edge (Geiger 1965, Van Arsdel 1972).

More frost susceptible trees can be grown in small openings or strips less than 1:1: D:H ratio, when they are being established in an old forest or woodland.

A frosty open field can be made less frosty by establishing rows of quick growing trees like cottonwood or willow. They can be grown from cuttings.

In Canada, the Northern Lake States, and in the high mountains (spruce-fir, jack pine, lodgepole pine, and colder regions), trees often cannot become established in open fields greater in diameter than four times the height of the surrounding trees because of frequent summer frosts. To establish pines, making clear cuttings 2-3 times the tree height should limit frost and reduce daytime moisture (if pines are 60 ft. tall, then make openings 120 to 180 feet in diameter). In mountains where snow blows away, 1:1 size opening is better to prevent winter freezing.

### Light

Light limits tree growth whenever a crown shades trees beneath. A common shade tree complaint for pines is "the lower branches are turning brown and dying." Remember this when you diagnose shade tree problems. There are three common maladies in which the death progresses upwards. One is shading, one is from frost, and one is from rain splashed pathogens, such as Elytroderma needle cast of ponderosa pine.

In the forest we speak of a lack-of-light injury as shade tolerance. Trees of an intolerant species are shaded out as crowns of faster growing trees close over them. The usual symptoms are browning and dying, but often the tree just produces fewer and fewer leaves until it gets below the critical level.

Turner and Aulitzky report that low light from clouds on the northern slopes of the Alps restrict tree growth in central Europe. Tolerant trees such as spruce and fir do better in such fog belts. (Hempel, 1961).

### Lightning

The long slash up the cambium spiralling down a tree where a one to four inch wide strip of bark has been ripped off is a common symptom of lightning injury. Near the base of the tree large long splinters of wood are often shattered out. Sometimes the whole tree is shattered. Some large trees are protected by lightning rods.

### Drought

The symptoms for drought injury are similar to wilt diseases and changes in grade (defoliation, resprout on hardwoods). True drought symptoms must occur, but often local drought killing reports have turned out to be a fungus wilt disease (Oak wilt, Cephalosporium wilt of live oak) or other problems. Many reports of drought or scorch look like salt toxicity to me, and I wonder if the authors checked the salt content of the leaves (Tattar 1978). The symptoms that occur on unwatered potted plants do not have the predictable symptoms that some of the other described maladies do.

Winter kill or winter injury is often a reddening (or browning) of conifer needles on the part of the tree exposed to a hot drying wind when the ground is frozen. It occurs most commonly in March. The red belt disease is the best known example in the United States, it results from a Foehn (Chinook) wind blowing down the east side of the Cascade Mountains in the Pacific Northwest and drying the trees excessively. Because of the salts added to the soil along the highways with snow and ice removal which increases the water uptake problem for the trees, this symptom is more common along highways and associated drainageways.

### Chemicals

Additional chemical problems are illustrated in my diagnosis paper on oaks (Van Arsdel 1978). Air pollution problems are illustrated by Jacobson and Hill (1970) and Loomis and Padget (1975). One area not adequately covered is that of browning of needles on pine trees, or browning of the terminal halves of the pine needles. These brownings are difficult to separate and identify in hard pines. They can be due to excess fertilizer, road salt, salt from irrigating water, reducing pollutants ($SO_2$), oxidizing pollutants (ozone,PAN). White pine needle blights can be reasonably well diagnosed from the papers of Hepting and Berry (1960) especially if aided by some from Linzon (1962, 1965).

Browning of needles is a common reaction to various chemicals, but on pines there is no general rule to separate these. Among the air pollutants there are oxidizers and reducers. Some oxidizers come from photochemical reactions. Nitrous Oxide in sunlight releases ozone. Peroxy-acetyl-nitrate is a photochemical produced from unburned petroleum hydrocarbons from car exhaust. Ozone can also come from lightning or subsidence of the high atmospheric ozone layer.

Sulfur dioxide is a common reducer. There can be synergism between the oxidizers and reducers. As a protective reaction stomata usually close in the presence of oxidizers, but $SO_2$ can keep the stomata open for the oxidizers to get in. To help diagnose the problems of pollutants the sources must be investigated. As an aid to diagnosis it can be noted that ozone often comes from a single event that makes the injury cover much of the growth that was present at the time of the injury. Sulfur dioxide tends to be a slower accumulation phenomenon, more localized on the leaf or needle, and often repeated. On pine needles this can pro-

duce alternating bands of injured and healthy tissue. The sulfur dioxide injury generally does not appear early in the growing season, in fact Dr. Patton called it the Fourth-of-July disease near a Wisconsin paper mill, because the injury showed up at the same time each year.

The control for pollutants is to remove the source, raise the stack height, or to use resistant selections where possible. Often there is nothing you can do.

## Conclusion

Environmental diseases are common and becoming more common as man increases his numbers and his activities. Often there is little you can do about them, and prevention is usually easier than curing them. Much can be done to prevent construction injury; therefore, we need to find a way to motivate the builders. Irrigation problems, including saline irrigation water damage, can usually be solved by the homeowner. Road-deicing-salt is a more difficult problem. Some care in the handling of salty snow can help, but in many cases the only solution may be mass political action. Frost, sunscald, and certain other environmental problems can be reduced with proper practices. Air pollution is a legal and political problem for the most part, and these must be used to modify the sources. Identifying the problems can help solve some environmental diseases, others may take long slow political action by concerned citizens.

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