Reclamation *from page 43*

Although some of the soluble sulfate may then precipitate out as gypsum ($CaSO_4 \cdot 2H_2O$), high levels of calcium and sulfate remain in solution. Much of the iron may precipitate out as iron hydroxide.

Soils workers commonly measure salt levels, which can be equated to TDS, as electrical conductivity (EC) and plant physiologists interpret salt effects in terms of osmotic pressure (Salinity Handbook 1954). A large osmotic disparity between the soil solution and plant cells can lead to unfavorable water relations and consequent impaired growth and photosynthesis, and even plant death.

Drought markedly increases the effects of dissolved ions.

Plants differ markedly in their tolerance to salt levels. As reported by Jackson (1958) EC may affect germination at 1 mho/cm, reduce growth of some "salt"-sensitive plants at 2, and result in severe injury to many species at 3 mho/cm. Some plants can grow at much higher salt levels. Plants adapted to high-salt soils have been found to increase their cell-sap concentration and maintain a favorable osmotic gradient and water supply (Ashby and Beadle 1957).

Salinity problems have been reported chiefly in relatively arid climates where pH, EC, and soluble sodium content are associated. Most natural soils of the humid, midwestern United States have low EC values irrespective of pH, and low sodium content. In contrast, midwestern mine spoils often have high TDS/EC values from sulfate, calcium, and iron.

Drought markedly increases the effects of dissolved ions. As soil moisture is depleted by evaporation and transpiration, the concentration of dissolved ions becomes progressively greater and some may even reach saturation. Roots thus may actually encounter concentrations of dissolved ions much more limiting than those measured using laboratory procedures.

Use of high-salt plants may be the most successful means of coping with TDS/EC levels. An established cover of adapted plant species will mitigate salt problems by reducing salt levels through ion uptake, and by furnishing a mulch on the soil surface and developing root channels which improve water movement down through a soil to hasten leaching losses of excess salts. Subsequent effects on stream quality must be considered.

Halophytes, or plants adapted to salts in soils, are characteristic of western areas with low precipitation. Some western species such as kochia which have flourished as weeds on midwestern stripmines may scarcely be present on adjacent farmlands. Their vigor may be related to an ability to compete favorably with typical midwestern species on mined soils with high TDS. The value of hardy pioneer plants in re-establishing vegetation should be recognized. Use of suitably adapted plants, within the constraints of management, is a key to successful reclamation.

Conclusions — Many stripmines differ from surrounding agricultural lands. The degree of difference is a variable related to type of overburden, climate, and other factors. Agricultural lands are typically ion-poor, and stripmines ion-rich. These ions are released from sedimentary rocks and minerals brought to or near the surface where oxidation and other weathering processes can take place. Iron sulfide (pyrite) is the dominant geochemically active mineral in overburden materials. It may be present in small but important amounts.

Pyrite oxidation liberates hydronium, ferrous, sulfate and other ions directly and calcium, magnesium, manganese, iron, aluminum, and other ions indirectly. Under present regulations acidity from pyrite oxidation which is not neutralized by basic materials in the overburden is controlled by applications of lime and other soil amendments. Some ions such as iron precipitate out at higher pH. Many ions such as sulfate or calcium remain in solution and are measured as high levels of total dissolved solids typical of mined areas. As soils are leached these ions move from sites of production to drainage waters. The loss of ions may be slow compared to the production.

Plant growth depends on a supply of ions from the soil and may be enhanced by the increased availability of minerals on mined lands. Acidity is not necessarily harmful to plant growth. An imbalance of ions, an excess of one ion, or a very high level of total dissolved solids can be deleterious to growth of some species. The plants to be used in reclamation should be carefully chosen for the site, particularly if the site cannot readily be changed to suit a certain species. Both native and introduced species or varieties may have suitable ranges of ecological tolerance for use in revegetation.

Literature Cited

Arnon, D. I. and C. M. Johnson. 1942. Influence of hydrogen ion concentration on the growth of higher plants under controlled conditions. Plant Physiology 17:525-539.

Ashby, W. C. and N. C. W. Beadle. 1957. Studies in halophytes III. Salinity factors in the growth of Australian saltbushes. Ecology 28:344-352.

__________, C. Kolar, M. L. Guerke, C. F. Pursell, and J. Ashby. 1978. Our reclamation future with trees. Coal Extraction and Utilization Research Center. Sou. Ill. Univ., Carbondale. 101 p.

Blumthal, J. E. 1977. Selected trace element distributions in pyrite in the coal seams of western Kentucky. M.S. thesis. Sou. Ill. Univ., Carbondale. 84 p.

Caruccio, F. T. 1970. The qualification of reactive pyrite by grain size. pp. 123-131 In C. T. Holland (ed.) Coal Mine Drainage Research. Third Symposium. Pittsburgh, PA.

__________ 1975. Estimating the acid potential of coal mine refuse. pp. 197-205 In M. J. Chadwick and G. T. Goodman, (ed.), Ecology of Resource Degradation and Renewal. Fifteenth Symposium of the British Ecological Society. Blackwell Scientific Publ. London.

Grandt, A. F. and A. L. Lang. 1958. Reclaiming Illinois strip coal land with legumes and grasses. Ill. Agri. Expt. Sta. Bull. 628. 64 p.

Harper, D. 1977. Selected trace elements from coals of southern Illinois. M.S. thesis. Sou. Ill. Univ., Carbondale. 65 p.

Hood, S. D. 1977. Water quality and waste treatment management planning in southern Ill. Geol. Soc. Amer. Abstracts with Programs, 9. p. 606.

Hood, W. C. and S. M. Stepusin. 1974. Manganese content of some southern Illinois shales and its relation to acid mine drainage problems. Twenty-third Annual Clay Minerals Conf., Programs and Abstracts, 23, P. 59.

Jackson, M. L. 1958. Soil chemical analysis. Prentice-Hall, Englewood Cliffs, N.J. 498 p.

Manganese 1973. National Academy of Sciences, Washington, D.C. 191 p.

Russell, E. W. 1973. Soil conditions and plant growth. 10th ed. Longman, New York. 849 p.

Salinity Handbook. 1954. Diagnosis and improvement of saline and alkali soils. U.S. Dept. Agric., Agric. Handbook 60. 160 p.

Smith, R. M., A. A. Sobek, T. Arkle, J. C. Sencindiver, and J. R. Freeman. 1976. Extensive overburden potentials for soil and water quality. U.S. EPA, EPA-600/2-76-184. 311 p.

JAPANESE BEETLE CONTROL: BIOLOGICAL AND CHEMICAL

While control of Japanese beetle larvae is a significant aspect of turf management in many areas, the larvae are only one type of several "white grubs" that may be inhabiting the soil. When applying a specific control for Japanese beetle larvae, specific identification is necessary.

The presence of grubs in general may be indicated by feeding activity of such animals as moles, armadillos, skunks, or large flocks of birds. The only way to specifically identify a grub problem, however, is to expose a portion of the turf rootzone and visually inspect it. The recommended manner is to expose a square foot of turf, two to four inches deep, and examine it for larvae. Several samples should be taken in any one area.

Japanese beetle larvae are white with a brown head. They are found, curled in the typical "C" position, in the soil around grass roots. They are distinguished from other grubs by the rastrel pattern.

The life cycle of the Japanese beetle is completed in one year. Adults lay eggs in mid-summer. By August, the larvae have hatched and are actively feeding on turf roots. The larvae then overwinter in the soil, and in the spring they rise to the surface again and feed. Adults emerge in June or July.

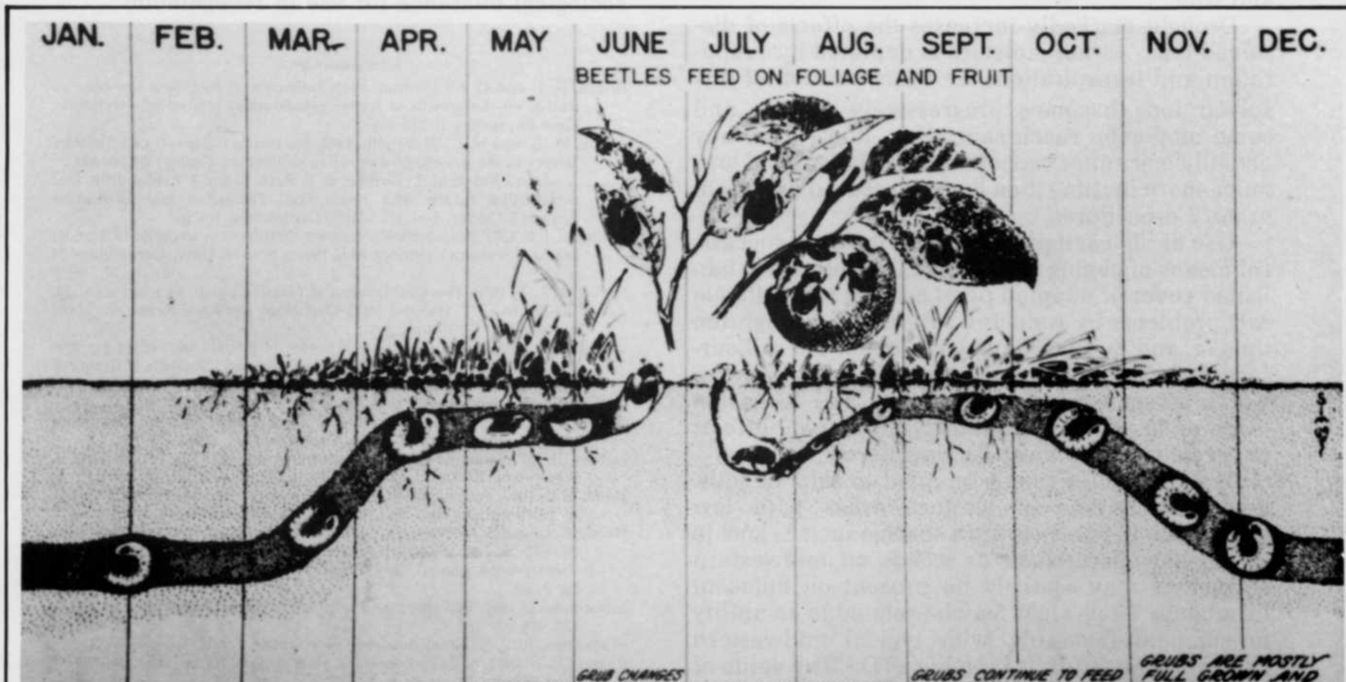
Milky Spore Disease

In 1933, scientists with the United States Department of Agriculture in New Jersey discovered a number of Japanese beetle larvae to be filled with a milky white fluid teeming with bacterial spores. The spores were identified as *Bacillus popilliae.* It was found that grubs infected with this disease died and left disease spores in the soil that would infect other grubs feeding on grass roots in that vicinity. The spores were found to be very resistant to dryness, cold, heat, and moisture, and remained viable in the soil medium for years.

Milky spore disease powder is prepared in the laboratory by growing numbers of infected grubs. The spores are mixed with a dust-type base and packaged. The powder is then spread over a grub infested area and washed in.

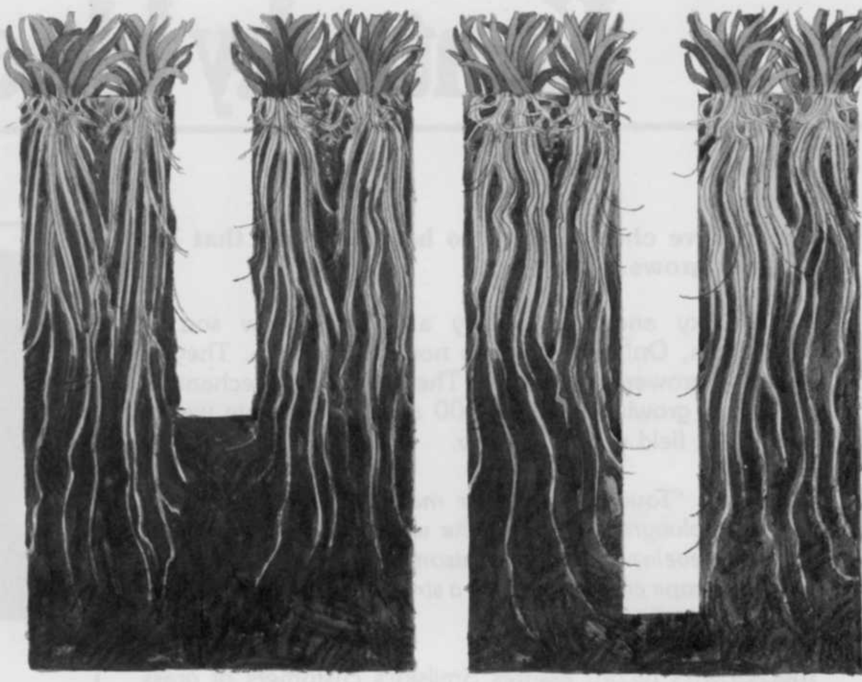
Recommended rates of application vary according to source, but it is generally agreed that the powder is placed in teaspoon heaps at distances of three to ten feet apart. Applied at the rate of one teaspoon per four feet, treatment equals ten pounds per acre. That rate is recommended by Reuter Laboratories, one producer of the disease powder.

Although the disease spores begin working immediately upon contact with feeding grubs, it



Grubs (larvae) feed on turf roots from August to winter and again in the spring.

Which aeration hole is better for your greens?



The answer, if you haven't already guessed, is the Greensaire II hole. And for good reasons.

One, it's deeper. The primary objective of aeration is to help air, water and fertilizer penetrate the soil. The Greensaire II removes cores up to 3″ deep, allowing these vital nutrients to reach the root zone where they're needed.

The fact that there are 36 of these deep holes per square foot means that you also remove more soil. This not only relieves the toughest compaction problems, but it also allows you to replace more of the old, depleted soil.

The Greensaire II hole is precise. It won't affect the roll of a golf ball, so your green is back in play sooner. You can aerate most greens in 45 minutes or less.

And when you use the Greensaire II, you can also use the unique Ryan Core Processor attachment. It catches the cores, separates good soil from debris, puts the good soil back on top, and bags the debris. You aerate, top dress and collect thatch in one operation.

If you want these same fine aerating qualities, but on a smaller scale, choose the Greensaire 16. It aerates a 16″ swath instead of a 24″, uses the same selection of tines and has a convenient windrow attachment that makes core removal easy.

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PLANT VARIETY PROTECTION CERTIFICATE No. 7400066 can take up to three years for full distribution within a turf area. The first symptoms of the disease should appear in grubs during the first one to two weeks, depending upon temperature. The disease will not develop at temperatures above 97 degrees F, and therefore cannot infect warm-blooded animals with higher body temperatures. It should be emphasized that milky-spore disease is not an insecticide, but a biological control agent.

The bacteria have two stages in their life cycle. During the spore stage, the bacteria are inactive and in a resistant condition. Once the bacteria are ingested by a feeding grub, they become active and multiply rapidly. Upon death of the grub, five billion or more spores may be released in the soil to infect other grubs. The length of time for disease spores to be distributed throughout an area depends upon natural movements of the grubs. The more larvae in the soil, the faster the disease spreads.

Some judgment is needed to decide whether to apply a chemical insecticide along with the milky-spore powder. Obviously, a high grub population will rapidly decimate a turf area. Some grub activity is necessary, though, to spread the disease spores. Milky-spore disease will remain, however, to prevent future crippling attacks by Japanese beetle larvae.

Grub

Adult

Chemical Control

Chemicals for control of Japanese beetle larvae include: chlorpyrifos (Dursban), diazinon (Dizazinon, Spectracide), fensulfothion (Dasanit), and trichlorfon (Dylox, Proxol). Refer to labels for specific labeling use directions.

Adult beetles can cause problems by skeletonizing foliage. Their control is more difficult, as new beetles are constantly flying from plant to plant. Most controls last only three to four days and must be repeated as necessary. Chemicals include: carbaryl (Sevin), methoxychlor (Marlate) and Sevimol. Again, refer to labels for specific directions. **WTT**

With Exhalt® 800 78% of your fungicide is still working even after a 2-inch rain...
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Unique encapsulating action makes it possible.

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

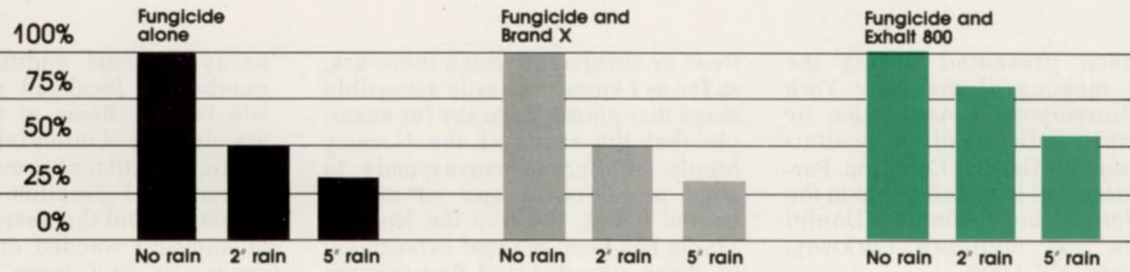


Chart shows how Exhalt 800 resisted wash-off in a laboratory test. Spray coatings were applied to glass panels and dried 10 minutes at approximately 70° F. Retention after erosion by rain was measured by solvent stripping the panels and determining the residual fungicide by quantitative ultraviolet spectroscopy.

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?

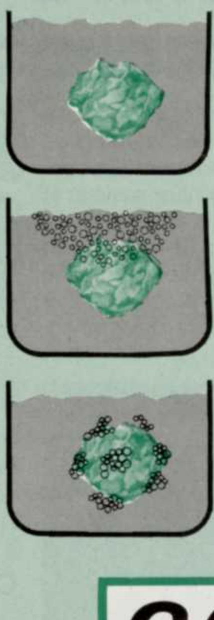
Obviously, some of your treatment is washed away. But the silver lining is *. . . some 78% of it is still in place and working.* Thanks to Exhalt 800's unique encapsulating power, you won't have to repeat the whole costly process again tomorrow.

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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TREES AND SHRUBS RECOMMENDED FOR HARDINESS IN THE NORTHEAST

A speech presented during the March meeting of the New York State Nurserymen's Association by William H. Collins, staff horticulturist, American Garden Cole, Inc. Persons interested in membership in the Association may contact Daniel Perkins, 144 Southern Parkway, Rochester, NY 14618.

Hardiness zones are probably the best single indicator for judging the general adaptability of trees and shrubs to a specific area. We would all feel more confident if there were similar but additional data that individually covered other weather factors such as the seasonal changes in rainfall, humidity, wind, elevation, days of sunlight and the like.

Most of us are further stymied by trying to fit into our U.S. hardiness zones, the many exotic (introduced) trees or shrubs for which there are, so far as I know, no easily accessible maps that permit us to say for example that the range of the Norway Maple of Europe corresponds to zone numbers so and so of the United States. It's true the Norway Maple has been planted extensively in North America and that through trial and error we can set up a pretty valid comparison. But what of the many Asian introductions whose origins and climatic conditions we know even less about. Where they were first collected may not be a total indication of their full range of adaptability in this country. Some of the Asiatic maples and birches are in this category and perhaps some of the elms and lindens.

Having lived along the south shore of Lake Erie and Lake Michigan and the north shore of Lake Ontario, I can understand that the evidence of what is, and what is not hardy depends additionally on a number of localized weather and site factors. Some of these factors are, number of miles inland from the shore, direction of prevailing winds, amount and duration of snowfall, elevation, and the nearness and size of adjacent wooded or open space areas. By and large these areas bordering large bodies of water are favored areas plant-wise. The extensive variety of plant material in the Morton Arboretum near Chicago, the Holden Arboretum near Cleveland, the Hamilton, Ontario Botanic Gardens and the notable woody plant collections in the Rochester area, both bordering Lake Ontario, indicate their more stable climates.

Region 5 of the New York State Nurserymen's Association (Genesee Finger Lakes Nursery Association) corresponds to a similar sized area in Ohio extending about halfway down the state from Cleveland.

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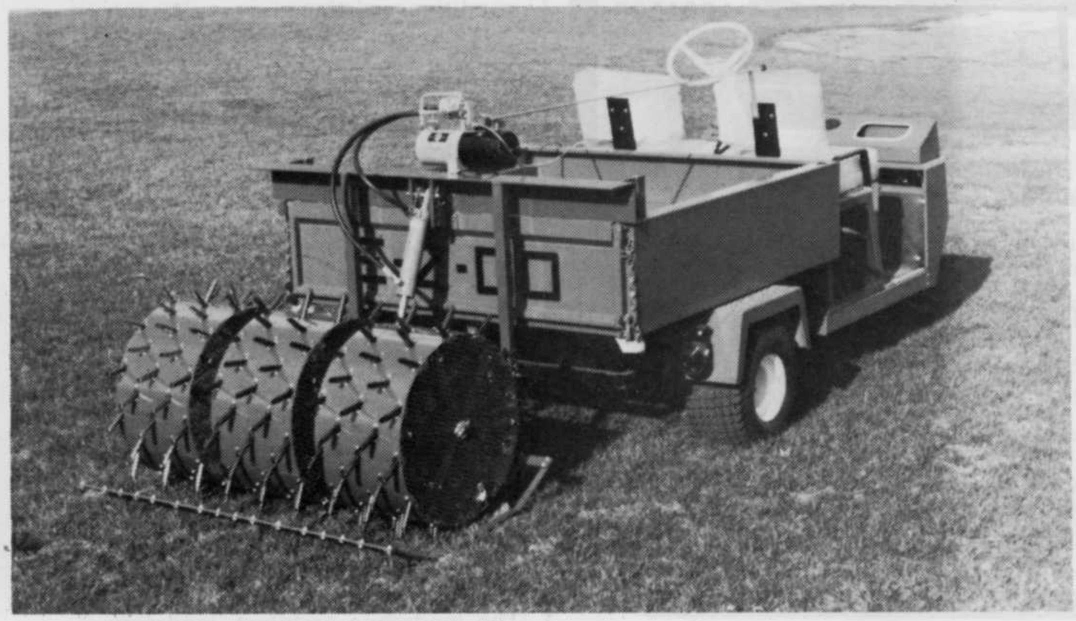

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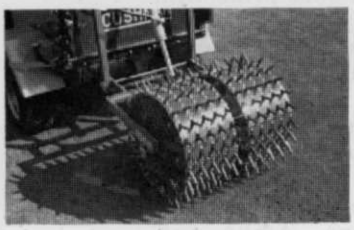

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Hardiness

There is one major difference. The New York area is one hardiness zone colder. Fortunately they're still able to plant most of the species we consider choice ornamentals.

We recognize that the growing conditions existing at some sites may contain specific physical or stress restrictions that limit the successful use of an otherwise adaptable variety. Conversely we have the opportunity to extend the landscaping palette by using some plant material tagged one or two zones less hardy if we provide the conditions needed for acceptable growth. A few examples of site modification are the use of protection afforded by northern and eastern exposures; improving drainage by tiling, mounding or amending the surface soil layer; planting or building windbreaks; establishment of overhead plantings to create filtered or high shade; and the use of ground covers. We frequently place Magnolias, Azaleas and Rhododendrons, Oriental maples, and great many of the broadleaved evergreens in this category. The landscape architect, landscape contractor, retail nurseryman and garden center manager cooperatively share tremendous pride with the client when "ify" plant material is successfully established. Prestige in the plant business results from continuously doing most things a little better than your competitors.

With the exceptions noted, the following in small to medium sized trees are considered dependable in Region 5: Maples, Amur and Japanese; Hawthorns, many but especially Washington, Cockspur, Dotted, Toba and English. The thornless form of the Dotted Hawthorn, 'Ohio Pioneer' and the Cockspur Hawthorn 'inermis' are especially suitable where the situation calls for