

Minnesota Nurserymen's newsletter

Prepared by
UNIVERSITY OF MINNESOTA
Institute of Agriculture

- Agricultural Extension Service
- Horticulture Department

In Cooperation with

- Minnesota Nurserymen's Association
- Minnesota State Horticultural Society



Vol. 8 No. 9 and 10

September and October 1960

WHAT CAUSES WINTER INJURY?

by C. Gustav Hard

The mystery of how some plants are able to withstand severe winter cold has long been a subject for research and speculation. Even today, with all the knowledge provided by science, many phases of this phenomenon still are not completely understood. The unique ability of many plants to stand the test of "hardiness" is often accepted without question. As examples, our native trees and shrubs apparently take the toughest winter conditions without the slightest injury. The Rugosa rose, long acclaimed for its ability to brave Minnesota weather, is a standby for Minnesota gardens. Yet, closely related species are only marginal in their ability to grow under similar conditions.

Obviously, there are inherent differences in plants. Trees, shrubs, and flowers from temperate or warm climates cannot be expected to adapt completely to a more rigorous climate such as that of Minnesota. However, some specimens may adapt themselves to a limited degree. Though rewarding progress has been made through hardiness breeding programs with many kinds of plants such as roses, chrysanthemums, fruit trees, and shrubbery, many gardeners are still trying to grow plant materials which are subject to various types of winter injury. It is within this large group of experimental or out-of-their-normal-range plants that many winter injury problems occur.

Experimentation is not the only reason that gardeners are intrigued by plants. Many of the plants subject to winter injury are grown for their exquisite beauty and fragrance. The hybrid tea roses are a good example. Many gardeners who have lost every rose in their garden have bought new plants the following year. To guard against this type of garden catastrophe, the general recommendation is to winter-protect. A heavy mulch or covering is suggested. However, research and experience have shown that winter injury may not be caused by extreme cold alone but can be caused by a whole complex of events and processes acting from within and without the plant to make it susceptible to winter injury.

Injury Symptoms

What are some of the signs of winter injury? Complete death of the plant is probably the most obvious. Die-back of the shoot growth is common. Killing to the ground line occurs on our cut-back type shrubs. Freezing out of the flower buds is common on forsythia. Browning of the foliage may occur on junipers, arborvitae and Japanese yew. Slow growth

in spring followed by death of the plant often indicates root damage. Unfortunately, many of these symptoms do not reveal themselves at the time the injury occurs --it may be weeks or even months later. Since the symptoms of winter injury are so diverse it is not surprising that the causal factors of the symptoms are diverse.

Assuming that a given plant has exhibited a reasonable degree of hardiness, what factors, then, of weather and climate as well as factors within the plant are going to determine its ultimate performance? Starting from the bottom of the plant, the roots are usually considered more hardy than the branches and trunk. This is due in part to the difference in soil temperature and air temperature. During periods of extended cold temperatures and when there is no snow for insulation, soil temperatures drop and may approach air temperature, at least near the soil surface. Thus after a winter that is extremely cold without snow, there are often reports of many trees and shrubs that never leaf out the following spring or whose growth is extremely poor. The symptoms may not show up until mid-summer.

To prevent the freezing of roots is not always possible. Where a tree or shrub is planted on a southwest or northwest exposure, the snow may not lodge and insulate the soil mass. High winds may blow away the snow or mulch. The suggestion is made that for sensitive species this site should be avoided. Many perennial plants can be protected where the overwintering storage parts are beneath the soil surface by using a heavy mulch (18" - 24" deep).

Desiccation

Winter drought and desiccation are closely allied. This injury is common to evergreens. During the winter the plant tends to lose water even though growth processes are at a standstill. Because the plant is unable to replace the water that is lost, injury results because of the dehydration of the plant tissue. This type of injury has been called "winter burn" and is sometimes called "sunburn."

There are several sets of conditions under which "winter burn" may occur. On the northwest corner of a home where the plant is exposed to extreme cold with high, dry winds, the symptoms are often seen. Usually the symptoms will occur on the side of the shrub facing the wind. A windbreak will provide protection against the cold dry winds, at least in part.

"Sunburn" is usually noticed on the south side of the shrub. As the air around the shrub is warmed by the sun, the shrub may lose water rapidly and since

it cannot be replaced, the sensitive plant tissues are dried out, causing the browning symptoms. This problem can be avoided by selecting a shaded location or providing shade for the plant in its present location.

An adequate soil water supply should be provided as the plants go into the winter. Thus when the plants are able to take up water it will be available for the plants to use.

Sunscald occurs on several susceptible species. The symptoms usually do not manifest themselves at the time of injury. However, later in the spring there may be a darkening of the bark on the south-southwest side of the tree. Later, there is a sloughing-off of the bark, leaving the woody tissue exposed. This injury is common on the Norway maple, mountain ash, and fruit trees. Often trees or shrubs which have been transplanted from conditions of heavy shade are susceptible to this type of injury. Trees may be protected by shading the sun-exposed side of the tree. Wrapping with a reflective material may also be helpful.

Suffocation

Suffocation of plants during winter is common. This problem is not as well understood as other types of winter injury. Apparently, suffocation is caused by any interference with the metabolic processes in the plant. Exclusion of a sufficient supply of oxygen, build-up of toxic gases, or interruption of the water uptake could cause this problem. The usual symptoms would be the death of the plant or at least a portion of the plant.

To avoid the suffocation problem, keep the mulch dry enough to avoid heating or organic breakdown. Avoid planting in areas which tend to flood or where water drains away slowly in the spring. Avoid planting where snow is likely to lodge and become compact.

Often during mild winter weather there is considerable freezing and thawing. This action causes two types of winter injury. Freezing and thawing of the soil mass has the mechanical effect of lifting a plant from its soil attachment, thus breaking loose its roots. Often perennial flowers are lifted completely out of the soil. The second effect is the breaking of the dormancy. This is particularly damaging when it occurs toward the end of the dormant period. Mild weather at this time may result in too early activity within the plant cells in preparation for growth. When this occurs, there is a lowering of the hardiness of the plant. When low temperatures return winter injury may result. Typical symptoms are dying back of the terminal growth or bud shoots.

Two methods are suggested for avoiding the freezing and thawing effect: 1) locate the planting where there is a minimum of temperature fluctuation and 2) use a mulch to maintain a more constant temperature. The mulch should be adequate for the individual set of conditions. Usually a minimum of 18 inches is recommended.

Minimum Temperatures

Every plant has its minimum temperature at which it will no longer survive. When this extreme

cold occurs, either the plant will be killed or it will be badly damaged. The minimum temperature at which a plant is killed may vary. Factors both inside and outside the plant are important. If the minimum temperature occurs after a pre-conditioning of the plant, then the plant is more susceptible to the extreme cold injury. However, if the temperature for several days has been above the minimum, the plant has been able to adjust to the lower temperature, the plant has a better chance for survival. This assumes that all plants can adjust to become more resistant to low temperatures. Many temperate climate plants do not have this capacity.

Succulent, lush growth is usually more sensitive to extreme cold than more mature tissue. This is why the gardener notices that growth made late in the season often freezes back during the winter, even on plants that are known to be very winter hardy. Any horticultural practice that might contribute to late growth may delay the maturing of the plant tissue and therefore may be a contributing factor to lack of resistance to winter injury. Such practices as late pruning on evergreens, fertilization to induce late growth, and shady conditions could be contributing factors to delay maturity.

The gardener should understand that extreme cold is not a fixed temperature for all plants. There is a distinct variable from species to species. The gardener must not reason that if the native redosier dogwood is hardy and resistant to winter injury that flowering dogwood is also hardy and will perform without problems. It should also be clear that proper conditioning prior to the extreme cold is also important in order that the plant may have time to adjust to the new condition.

The duration of the cold temperatures may be significant. When mulches have been used to protect against extreme cold and the cold temperatures persist over a long period of time, the value of the mulch may be lessened.

The various ways in which plants may be injured by winter conditions would indicate that to grow successfully certain marginal or semi-hardy plants, three practical points must be given careful consideration: 1) select those that are most apt to grow within the Minnesota climate and season limitations; 2) provide cultural practices which will work toward the advantage of the plant; and 3) provide protection which will take into consideration temperature extremes and yet not provide an environment which might be hazardous to the plant.

Gardening is a challenging art that taxes the gardener's skill to provide for his plants. A gardener must know the site, the soil, and the plants with which he is working to provide for them most adequately.

As every gardener with an experimental point of view knows, bringing a not-so-hardy plant through the winter to bloom again is a most rewarding experience.

Reprint from Minnesota Horticulturist,
October 1960.

Robert B. Morrow and Philip M. Raup

The expansion of cities is the major evidence in America of the population explosion that has occurred around the world in recent decades. Rural people cannot ignore this trend, for it is moving populations from the hearts of cities into suburban areas and introducing urban type settlement far beyond the formal boundaries of our metropolitan centers. Because most of the job opportunities will lie in the cities this expansion and consequent dispersion of urban workers into the countryside can be expected to continue.

The private automobile has been the key force leading to this increase in commuting to city jobs. As we get more and better highways, our suburban residential and business areas tend to form in clusters along the main transport arteries. This ribbon pattern of settlement, together with the rapid growth of the more conventional suburbs, has moved urban types of land-use problems far into the once open country.

Problem Situations

These expansion and settlement patterns have led to a variety of related problems. The major ones are listed below:

1. Incompatible Land-Uses. This arises when adjacent land-uses are completely unsuited to each other. Examples are a junk yard next to a trailer court or a livestock feeding operation next to a school.

2. Pollution. The most common cases involve the contamination of water supplies where private water and sewage systems are in use, and the contamination of air with smoke and smog.

3. Rural Slums. Unrestricted construction and use of summer homes, hunting cabins, camp sites, or unsafe and unsanitary rural residences can lead to the development of rural slums. This is particularly true if temporary shack-type construction is permitted.

4. Public Services. Rural population increases lead to more and often conflicting demands for public services. Newer residents often do not settle near available public facilities, but they need schools, police, fire protection, and service road construction and maintenance. Financing these services is a problem since the tax base of most rural communities is low, and often is not improved by an influx of rural residents who work and shop elsewhere.

5. Roadside Land Use Conflicts. Problems of roadside "blight" may develop around approaches to the major highways, particularly along the new interstate highway system. Federal regulations strictly prohibit direct access to restaurants, motels, residences, or gas stations from the interstate highways. This will force these types of land use into clusters at the principal interchanges, many of which will be sited in the open country. The orderly development of these activities will become the direct responsibility of local units of rural government.

Problems of concentration of persons and business activities have long been a part of the urban scene. Cities have found that they can best control these problems by designating certain areas for particular types of activities. Zoning is the general term applied to the system of controls, ordinances, and building regulations which are enacted to enforce compliance with a predetermined plan of development and the use of land.

Prior to 1959 some counties and townships in Minnesota have had authority to zone, but there has been no comprehensive legislation for all rural areas. Townships also have some power to guide development through the use of the platting regulations. In general, the townships have made little use of zoning authority. This has probably been due to the fact that the township boards do not have technically trained staffs. Supervisors serve for nominal pay and generally it is only a part-time job. They are not in a position to devote time to the long-range planning which is a necessary aspect of effective zoning.

1959 Legislative Changes

Any township may zone under authority of the laws of 1959, Chapter 566, coded as Minnesota Statutes, Sec. 366.182. The township zoning plans must be approved by 70 percent of the persons voting on the issue. Counties with under 300,000 persons are also authorized to plan and zone. (Chapter 599, coded as Minnesota Statutes 394.21-394.37.)

It is expected that the counties will be the most active in rural zoning. They have the authority and the capacity to raise funds for the preparation of comprehensive development plans and to employ planning directors, inspectors, or other personnel. They appear to be the more logical and effective units to undertake rural zoning activities.

The new procedure whereby counties may plan and zone is as follows: The board of county commissioners must first pass a resolution declaring its intent to proceed with planning and zoning activities. The board should next prepare a comprehensive plan for the orderly physical development of the county or for the parts of it that they wish to zone. The county board does not have to submit the plan to the voters, but hearings on the proposal are required.

The powers of counties to enforce their plans are derived from their "police power." This is the authority that any sovereign state holds for the protection and promotion of the health, welfare, and safety of its citizens. The police power is delegated to the counties, townships, and municipalities for zoning purposes. Ordinances are passed to insure compliance with the overall development plans. The major features of these ordinances generally are as follows:

1. The establishment of zoning districts. Certain areas are restricted to given uses, such as residential, agricultural, forestry, recreation, industrial, commercial, or combinations of these uses.

2. Regulations to guide building location, height, set-back, and size of yards or service areas of the various activities designated for the particular district. The regulations may differ between the zoning districts but they must be similar for all classes of property within a specified district.

3. The preparation of maps to show the planned location of roads, parks, streets, and service facilities such as school, playgrounds, and water and sewage facilities.

Before any controls or plans are adopted, public hearings must be held in order that the public may present its views on the proposed zoning plans. These hearings must be announced at least 10 days before they are to take place.

Whenever a county board adopts official adjustment, the board must act upon questions which arise from the administration and interpretation of the maps and ordinances. The decisions of the board of adjustment are not necessarily final and aggrieved persons may appeal to the district court if they are dissatisfied.

Persons who are injured because of lack of enforcement of the ordinance may cause enforcement by bringing an action against the responsible officials.

In the use of controls on property the test of reasonableness must always be applied. Any unreasonable rules or the discriminatory treatment of similar types of properties would probably be reason for the courts to declare the ordinances invalid. Unreasonable ordinances could lead to an abuse of the police power or to the confiscation of property without due process of law.

Counties which had zoning authority under previous legislation now have the option of zoning under either the previous authority or under the 1959 laws. If they already have zoning ordinances they may incorporate them into any new plans or they may continue with whatever system they now have.

While the zoning jurisdiction of counties does not apply within the boundaries of incorporated municipalities, the two governing bodies may cooperate and draw up a joint plan. The plan would not, however, become effective in the municipality until it officially adopts the plan. This type of arrangement also applies to townships which may already have zoning regulations.

In the event townships have not acted and the counties adopt official controls, the townships (except those having power of villages) are then prohibited from passing any ordinances inconsistent with the county plan.

Effectiveness of Rural Zoning

In order for rural zoning to be an effective device in orderly land use development, the regulations should be adopted before offending land uses begin. Once a land use activity is started, zoning ordinances alone are usually ineffective in stopping it. Zoning is most effective as preventive medicine rather than as a curative or "surgical" remedy.

In the final analysis the effectiveness of rural zoning will be determined by the electorate of the

counties. Through their support of county commissioners who are associated with the zoning issues, the citizens can make their desires known.

Whenever roads, schools, or private homes or businesses are established within a county some sort of planning goes on as to where they will be located. The use of the existing authority to provide a comprehensive development plan for the county will aid integration of private and public planning. With this higher degree of planning some of the problem situations cited above may be prevented. The authority now exists whereby local officials may zone in rural as well as urban areas. The decision to act clearly rests with these officials.

--Minnesota Farm Business Notes.
No. 415 - March, 1960

STORAGE OF FUNGICIDES

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Fungicides are among the most important tools that you have available for the control of plant diseases in your greenhouse. As such they should be given the same care as other tools and equipment used in the growing of the flower crop.

Too many times we have found fungicides kept under a bench or half-buried under junk in a damp storage shed. Containers are often open or torn or the material has been transferred to an old jar or paper sack. In some cases we have seen material which have not been on the market for at least 7 or 8 years. The labels were barely legible and the fungicide itself so badly caked that, even though some effective concentration of the active ingredient remained, it is doubtful if the material could be made up into a usable spray suspension.

Here are some helpful hints on the correct storage of your fungicides:

1. Store the fungicides in a cool, dry place.
2. Keep the materials in their original labeled container. Labels supply important information for the correct and safe usage of the fungicides.
3. Keep fungicides tightly closed in their original container so they retain their effective concentration longer. The original container was especially designed for the storage of the material--use it. Fold the tops of bags over several times to close the package tightly. Keep the tops of cans and jars tightly in place.
4. Keep the package arranged in an orderly manner where they can be found readily when needed.
5. Do not store fungicides in the same room as 2, 4-D type weed killers. The fungicides may absorb the weed killer fumes and cause injury when sprayed on the flower plants.
6. As soon as new fungicides are purchased, mark the year of purchase on each individual package with a crayon.

Under the correct storage conditions most fungicides will keep in good condition for several years (see table), but a date on a package at the time of the yearly cleanup and inventory will aid in determining which materials are no longer effective and should be thrown out.

Approximate Shelf Life of Various Fungicides *

(When stored in original tightly closed container in cool, dry location)

Very stable - Captan, ferbam, Karathane, liquid mercury formulations, Semesan, Vapam.
Stable for 1 year or more - Zineb.
Stable for 2 years or more - Maneb.
Stable for 3 years or more - Terraclor, Omazene.

*Rhode Island Nurserymen's Newsletter No. 2, June, 1960.

NOTES FOR NURSERYMEN

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Chemicals For Treatment Of Nursery Stock In Storage

We have had a number of requests from various nurserymen for information on the chemical treatment of nursery stock to prevent grey mold in storage.

Captan has given good results when used on nursery stock at the time it is put into storage. Another attribute of Captan is the comparative safety with which it can be used. It is a preventive fungicide and, therefore, should be used before infection appears. It can be used as a spray, dip, or dust. A 7.5 percent dust may be used, dusting the bundles as they are put into storage. If preferred, a mixture of 2 pounds of 50 percent Captan wettable powder per 100 gallons of water may be used as a dip or spray. Each nurseryman could choose the method most convenient for his situation.

Terraclor or PCNB 20 percent dust has been used successfully in stopping outbreaks of grey mold in storage.

Mites

The development of various species of mites during the late summer hot weather was quite serious. Spider mites were most common. A new problem, however, developed in several nurseries. Mites of the eriophyid group became more troublesome this year than every before.

This mite is smaller than the ordinary spider mites, being microscopic in size. Its shape is odd, coming to a point at the posterior end. There are probably a number of species. We have found members of the group present and doing damage on raspberries, shade trees (sometimes on the terminal growth) and Black Hills spruce. It appears that they are most prevalent on the dense, closely sheared spruce.

Several chemicals have proved to be effective when used to control this pest. Systox has been very good but is not generally recommended because of the hazard associated with its use. Kelthane, when used at 3 or 4 pounds per 100 gallons of water, has

been fairly effective. A combination of Kelthane plus Dimethoate, a new chemical, may prove to be valuable because Dimethoate is safer than Systox, yet it has systemic action as does Systox.

SUGGESTED REFERENCES FOR NURSERYMEN:

Disease and Pests of Ornamental Plants by Dr. B. O. Dodge, Dr. H. W. Rickett and P. P. Pirone.

This book is recommended as a reference for easy identification and suggested controls.

This book is a famous reference work resulting from Dr. Dodge's many years in plant pathology at the New York Botanical Garden. During this time he was constantly answering questions from gardeners troubled with plant diseases or pests. The need for a dependable, practical work on the subject became obvious. Dr. Rickett worked with Dr. Dodge in preparing the resulting manuscript which earned high praise and wide acceptance. In the third edition, Dr. Pirone has thoroughly revised and updated the text, especially the "Control" measures, and has included scores of new illustrations.

The book is an essential reference for nurserymen, florists, arboriculturists, landscape architects, landscape foresters, and horticulturists who have disease or pest trouble and want a modern, authoritative source to help them to establish what the symptoms mean and to give them precise directions about control.

New lawn disease bulletin, Lawn Diseases--How to Control Them, in a new bulletin from USDA presenting lawn diseases and problems in color. This is a handy reference for identifying common diseases which may infect a lawn.

This bulletin may be obtained by writing to the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. Include 10 cents for mailing.

University of Minnesota Landscape Arboretum, Miscellaneous Report 38, is a progress report of the Arboretum from its beginning until the present. It gives a good report of the progress in physical and planting development as well as the research. Since this is the first Arboretum report, nurserymen will want this publication for future reference.

TREE WOUND TREATMENT

Wounds on the trunk and branches of shade trees are common. They stem from a wide variety of causes--skidding automobiles, carelessly operated lawn mowers, bark-gnawing rodents, pruning, wind and snow storms.

A wound occurs when a section of the bark is destroyed in any manner. Bark is a protective cover; if it is broken the underlying tissues are exposed to attack by wood-decaying diseases. Once established, these may move into the heartwood and produce cavities that result in loss of the tree.

According to procedures advocated by the National Arborist Association, all wounds should be treated as promptly as possible after their occurrence to lessen the chance of disease invasion. The manner of treatment varies somewhat with the nature of the wound.

In wounds resulting from impact by automobiles or other heavy objects, an irregular-shaped section of bark often is torn away, the sapwood gouged and splintered, and the bark at the edges of the wound loosened. Somewhat similar wounds may be caused by squirrels and rabbits in feeding on the bark.

When treating wounds where the bark is torn, cut away the loosened edges with a sharp knife or a mallet and chisel, and smooth the splintered wood. Then shape the wound to form a pointed ellipse with the long axis parallel to the length of the stem. This shape favors healing since callus growth develops primarily along the sides of a wound rather than from the top and bottom.

Preliminary shaping of pruning wounds is done as a part of the pruning operation. In removing a branch, make the final cut as close as possible to the parent stem. Never leave a stub. Smooth the surface of the cut, removing roughened or torn bark and protruding wood.

The final step in treating any wound is the application of a good quality tree wound dressing, available at garden supply stores. Usually this is an asphalt base paint containing a disinfectant, but free of chemicals that might injure the living tissues at the edges of the wound. Such dressing materials are the best known substitute for living bark.

To be effective, the film of wound dressing material must be intact during the entire time the wound is healing. Therefore you should inspect treated wounds occasionally and, if cracks or checks have developed, reapply the dressing.

-Indiana Nursery News, January, 1960.

FEEDING BETTER THAN SPRAYING TO CHECK EXCESSIVE SEEDS

Shade trees can be sprayed with growth-regulators to curb the formation of unwanted seeds and fruit. But in many cases the spray results in serious injury to the foliage and sets back the trees.

The danger is in the dosage required, says Dr. Rush P. Marshall, director of the Bartlett Tree Research Laboratories. Fruit-set sprays used to hold back orchard fruit must be doubled in strength, for example, in an attempt to prevent development of nuisance seeds on Norway and silver maples.

Here and there, however, individual success may be achieved. The female fruit of ginkgo trees is malodorous when it ripens and falls.

In Baltimore where one street was lined with ginkgos the juice of the fruit was tracked into church. This was so annoying that all the female ginkgo trees had to be removed; the male trees which bear no fruit were left standing. But last year in another area

female ginkgo trees were sprayed at blossom time in May with a growth regulator and no fruit formed. Neither was there damage to foliage.

Yet the same spray applied to horsechestnut trees to control seed formation was ineffective.

The most common seed-nuisance trees are Norway and silver maples on lawns and along streets. Norway maples are especially messy because they shuck off blossoms in April and then drop seeds almost continually into late fall.

Trees which form excessive seeds are often weakened. Boost them back to health with feeding and periodic pruning and chances are they will form fewer seeds. More of their energy will go into growth of leaves and twigs, and less into seed.

TIPS ON TRANSPLANTING TREES

Here are some observations from one who has had considerable experience transplanting large trees:

1. Wrapping the tree trunks with burlap appears to be superior to the use of paper wrap. Dipping the burlap first in a lime sulphur solution and painting the trunks and larger branches with lime sulphur also helps resist borer attacks. Dipping the burlap is, of course, done prior to wrapping the tree trunk and larger branches. Transplanting has been most successful when the trunks and larger branches of trees, 3/4 to 1 inch in diameter, have been wrapped.

2. Wood chips are the best storage medium to use when balled and burlapped trees must be stored before planting. These are chips which arborists accumulate in their tree trimming operations, that is, if they have a "chipping machine" to chip branches.

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