Journal of the Minnesota Academy of Science

Volume 9 | Number 1 Article 5

4-1941

Hardiness Of Woody Plants In Minnesota

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Biological Science

THE RATE OF ANGLING AND ITS EFFECT ON THE FISH POPULATIONS OF SOME NORTHERN MINNESOTA LAKES

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ABSTRACT

1. Creel censuses were made on all fishes caught during the summer of 1940, from five northern Minnesota lakes, determining the kinds and numbers caught.
2. The total poundage and rate of catch were determined for each lake.
3. By means of scales, the ratios of the age classes composing the catches were determined.
4. The rate of growth for the fishes of each lake was also determined.
5. The fishes from the lakes with the heaviest fishing showed a slower growth rate.
6. This corresponds with the growth rate of fishes from heavily fished lakes near the Twin Cities.

HARDINESS OF WOODY PLANTS IN MINNESOTA

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The continental climate of Minnesota limits the number of species of trees and shrubs that are hardy here to a relatively small number as compared with other sections of the United States. Indeed, Minnesota and North Dakota are in the lowest zone in Rehder's map of hardiness. The long period of cold when there is no intake of water by the root system but when twigs and needle leaves give out water leads to so-called winter-killing. Likewise long periods of summer drought may lower the water level so that species ordinarily hardy may kill out from that cause. The result is that the material with which the landscape gardener can work with assurance of success is all too limited and indeed is discouraging when compared to the wide selection available to the gardener in zones

farther south or nearer the tempering influence of the oceans. Trees and shrubs are the pigments with which the landscape architect paints his picture, and the greater variety of these pigments that he has, the more effective can he make his picture.

In this paper we pose the question: What means may be employed to increase the number of tree and shrub materials for the use of the landscape gardener in Minnesota? The means will be considered under the following heads:

1. Introduction of species and varieties now unknown in the state.
2. Widening the acquaintance with species that are hardy but little known.
3. Acclimatization of plants to our conditions by judicious choice of soil, exposure, and in some cases by supplying protection.
4. Breeding for hardiness.
5. Selecting for hardiness.

The first method, the introduction of hardy species from outside the state, is the one that has been employed to give us the majority of the ornamental shrubs that we now use, though that is not true of our ornamental trees. The possibilities of introduction of new materials from other sections of this continent have apparently not been exhausted. It is possible that the northern Rocky Mountains still have species that may prove successful. The Ponderosa Pine succeeds so well that it has been introduced in the nursery trade. *Pinus aristata* from Colorado likewise succeeds here. But we cannot learn of adequate tests of Limber Pine (*Pinus flexilis*), Lodgepole Pine (*Pinus contorta*), as well as other western species and some of the southern pines worthy of consideration. Similarly, while the Concolor Fir has long been in the nursery trade here, there is no proof that some of the other western firs would not prove hardy if selected from the right geographical situations. By such geographical situations we mean areas not only subject to low temperatures but also to low humidity. A tree from an area of generally humid atmosphere, even if the temperature might drop to 30 degrees below zero, would hardly be expected to succeed here on account of the limiting factor of moisture.

Some species of shrubs that have not naturally migrated into this region, may prove hardy here if introduced. The Yellow-wood (*Cladrastis lutea*), being native in Georgia and Tennessee and westward to Missouri, would hardly be suspected of being worthy of trial. Yet it goes through the winters quite successfully in Faribault. *Fontanesia fortunei*, a relative of the Lilac, is another similar example of a shrub long since introduced in the south, but now proving winter hardy in Faribault and in the Carleton Arboretum, and promising to become one of our valuable hedge plants.

But the greatest number of introductions in the future may be expected from the continent of Asia, if we may judge from past

experience. Thus we have obtained from Mandschuria the Amur Cork Tree (*Phellodendron amurense*), which has proved hardy through winters since 1929 in the Carleton Arboretum and is a valuable addition. Similarly the Japanese Birch (*Betula mandschuriana*) is equally hardy. One of the most valuable Lilacs is *Syringa oblata dilatata* (Nakai) Rehd., a Korean species in the Carleton collection introduced recently to this country. It blooms earlier than most of the French lilacs and continues to bloom for as much as three weeks in some seasons. At the same time it has a strong fragrance. We may expect future introductions of similar quality to these examples, since the highland provinces of Asia will no doubt continue to yield up new materials as they are further explored.

In this connection it may be said that South America may be almost completely discounted so far as giving us anything new for our climate. It is true that shrubland is found in elevations where temperatures fall well below freezing, but only in those regions which have at the same time adequate moisture distributed throughout the year. The plants are therefore not resistant to our periods of dry cold. The Andes hold a wealth of material for the gardeners of California, Oregon, and Washington, but practically nothing for Minnesota.

Secondly, the materials of the landscape gardener may be enriched by a better acquaintance with species and varieties that are hardy but are little known in the state. Some of our native dogwoods, the New Jersey Tea (*Ceanothus americanus*), the Winterberry (*Ilex verticillata*), the Buttonbush (*Cephalanthus occidentalis*), Mountain Maple (*Acer spicatum*) the Hop Tree (*Ptelea trifoliata*), some of our native Hawthorns (*Crataegus* spp.), various species of Wild Rose, the Prickly Greenbriar (*Smilax hispida*), are all examples of attractive plants which nurseries seldom offer but which the landscape gardener could use to great advantage in the right situations if he were acquainted with the plants. *Ilex verticillata* makes vigorous wild growths near Cedar Lake in Rice County and the shrubs yield a wealth of red berries that cling in the fall and winter making an attractive display. These could possibly be successfully cultivated as a source of Christmas decorations. The Buttonbush is likewise wild in the same region but is seldom seen in ornamental plantings, though the pendent globose fruits cling late in the winter and add something of interest to the winter picture.

Thirdly, there is a long list of plants which we ordinarily label as half hardy or doubtful some of which could possibly be acclimatized if their requirements of soil and exposure were studied. Some plants are very limited as to their soil requirements and when introduced into a soil that is not favorable, they do not succeed and are therefore stricken from the list whereas they might succeed if the soil were properly selected or conditioned. In Northfield, the Tulip Tree (*Liriodendron*) dies to the roots each winter in a sandy soil while a

tree on soil with a large proportion of clay has gone through five winters without injury, although it is more exposed than are those in the sandy soil along the river. Similarly the Tree of Heaven is only a root perennial in low sandy situations while, on higher clay and sand mixture, trees have attained a height of twenty-five feet in the course of five years. With respect to the Tree of Heaven, it may be said that even if it kills to the ground each winter it yet is of use in landscaping for its vigorous tall large-leaved shoots that spring up each spring. Certain species may be sufficiently desirable to merit some winter protection such as is already practiced in the cultivation of Roses. In the Carleton Arboretum we have experimented with coating the shoots of Tree of Heaven with paraffine wax in an effort to prevent winter drying. To date this is without success but it is possible that the twigs and buds are sealed too tightly by the use of paraffine. We have secured a Du Pont product recommended for this purpose which may possibly be useful but it cannot yet be said to have had a fair trial. Some of the doubtful species are probably discarded when they have succumbed to the occasional winter that is particularly severe. If anyone had recently introduced for the first time the Savin Juniper, which we regard as very resistant, he might have concluded this spring that the species was not hardy here because the winter proved particularly drying to the twigs and foliage and, in Rice County at least, many of these trees look very unsightly at this time. Similarly one might have come to the same conclusion with respect to Arbor Vitae in 1935 and 1936, when a prolonged drought and lowering of the water killed many of these trees. That species do become acclimatized is good reason to choose carefully the source of the material introduced. It is a common rule of thumb to get our seeds, buds, or nursery stock from as far north as possible. Probably of equal importance is the consideration of the dryness of the winters, i.e., the average relative humidity of the atmosphere. Beech has commonly failed in all efforts made to establish it here so far as we know. Were this tree to be introduced, it would be possible to get seeds or seedlings from farther north than our own latitude if one went to the Atlantic seaboard. This however would hardly be the best region because of the high humidity of the atmosphere in that region. A better source would be an area subject to prolonged periods of low humidity in the winter. Mr. Loss of Lake City relates an incident that illustrates well the importance of acclimatization. We ordinarily regard the Boxelder (*Acer Negundo*) as perfectly hardy here; sometimes it becomes such a weed tree that we regard it as too hardy. Several years ago a North Dakota nursery found itself short several thousand Boxelders that it had sold. The stock was ordered from a nursery in France. The trees were received, planted, and grew well during the summer but in winter they killed to the frost line. And further, every winter following they killed to the ground, thus proving to be only root perennials. Had this been the first ex-

perience with this species in this section, it would probably have marked the species as impossible here and doomed it for any further trials. Some of our present doubtfully hardy species are probably in this category.

4. Breeding for hardiness. This probably offers the least promising of means for increasing hardiness. It is a matter of years from seed to seed and generations cannot be obtained in quick succession as in the case of annual plants. From 213 species and varieties of the Maple (*Acer*) that are described, it should be possible to combine some of the desirable qualities of southern species with the hardiness of species from the far north. However, while there is some hybridization in the genus, it is not one that hybridizes easily. An example of a genus given more readily to hybridization is Juglans. In the Carleton Arboretum, the hybrids between Butternut (*Juglans cinerea*) and the Japanese walnut (*Juglans Sieboldtiana*) are as hardy as is the butternut itself. However, we do not know for certain that they are more hardy than the parent *J. Sieboldtiana* as we have not seen trials of this species other than some trees at Medford, Minn., which had attained an 8″ caliper. What the possibilities are in the matter of hybridization of trees and shrubs for ornamental purposes we can only surmise by surveying the success attained in the cross breeding of fruit trees by our horticulturists. Furthermore, the United States Forest service is seriously engaged in the improvement of forest trees by hybridization.

5. Selection for hardiness. We are coming to picture a species as a group of biotypes. Hardiness is a factor that is variable among any number of biotypes. It would seem reasonable then that selection and reselection if persisted in long enough would lead to a strain that had the highest degree of hardiness. That is in fact the way that natural selection managed to push species farther and farther into the colder zones from a tropical climate. While the time factor is important here, it is also true that man can prevent much waste of time by selecting intelligently. Redbud (*Cercis canadensis*) is often reported as not hardy in Minnesota by those who have tried to grow it. Yet, some trees in the Carleton Arboretum have withstood seven winters without protection and they bloom profusely each spring. Loss reports a Redbud at Winona that had a crown spread of 15 feet and a caliper of 10-12 inches before it was killed by the drought. Possibly these successful individuals represent biotypes of unusual hardiness from which reselection would produce an altogether hardy race.

When we consider what has been achieved by selection in the realm of crop plants, we must conclude that this method holds the best promise for enriching our landscape materials in the future although, because of the length of the generations in trees and shrubs, it must of necessity be a slow process.

We are accumulating data on experiences with hardiness from various sources in the State at the Carleton Arboretum, and we in-

vite contributions of information from those who have had experiences with unusual species of trees and shrubs. At the same time, we shall share at intervals the accumulated information with those who are interested.

A WOODLAND TRAGEDY

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ABSTRACT

This is a brief description of a dental anomaly in the skull of a woodchuck — Marmota monax. Normally the upper and lower incisor teeth form an effective chisel-like cutting edge in all rodents, enabling them to secure their food by gnawing. Statements similar to the following have continued to appear in the literature on rodent dentition: "Since these teeth grow throughout life, if they are not worn away by gnawing, they become too long and the animal can not feed." The incisor teeth of the skull in question are deflected so that gnawing was impossible. The exposed parts of the two lower incisors are nearly seven times longer than normal. The upper incisors form a complete ring; the left one is recurved upward on the side of the left maxilla; the right one is curved into the mouth cavity and up through the maxilla into the nasal cavity. Nevertheless, this animal did not meet death through starvation. On the contrary, it appeared to be well nourished at the time of death. The real test of the survival value of these teeth came in an unequal and, for the woodchuck, unsuccessful encounter with a dog.

NUTRITION OF THE WAX MOTH LARVAE. VITAMIN REQUIREMENT. I. REQUIREMENT FOR VITAMIN B_1 *

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All evidence available at present indicates that vitamin B_1 is necessary for the growth and development of insects (Migicovsky, 1937; Fröbrich, 1939; Offhaus, 1939). There is no study on the vita-

* Paper No. 1900 Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul.

** The writer wishes to express his sincere appreciation to Professors M. C. Tanquary and W. A. Riley for their interest in the experiment and for valuable suggestions and corrections during the preparation of the manuscript.