

Chinese Elm Injury in 1942¹

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IN THE SPRING OF 1943, many tree and shrub species on the northern Plains were found to have suffered an unusual amount of injury during the preceding fall or winter months. Investigation of this injury leads to the belief that it was caused by a combination of climatic conditions in September, 1942. Chinese or Siberian elm (*Ulmus pumila*) was one species on which the injury was prevalent. It has been extensively used for both farm and city planting during the past 15 to 25 years and enjoyed considerable popularity as a fast-growing tree. Growth habits of the species would class it as "long-season" in that it is among the first to commence growth in the spring and seldom ceases growth or matures its wood before the first killing frost in the fall. Trees planted on low, wet, or high water table sites usually do not live many years, possibly owing to their late-maturing habits. On such sites the readily available moisture prolongs the growing season and causes the unripened wood to be easily injured by freezing temperatures.

The first observations indicating that injury had occurred to this species were made in early April. An examination of three-year old trees at that time revealed that all buds were dead and that the bark appeared to have a decayed appearance. Closer examination showed that the cambium was dead and the sapwood had a decided "brownish" appearance. Indications were that the injury had been caused before the wood matured the previous fall rather than during the winter in which case the wood would have had a greenish tinge in the spring.

The spring season was unusually cold and backward, which delayed growth of all plants. It was not until the middle or lat-

ter part of May that any accurate prediction could be made of the extent and degree of injury. Ordinarily, buds of Chinese elm commence to swell about April 1, flowers commence to appear about the end of the second week, and leafing out is in full progress by the end of the month. When leafing out did commence, the injury became very apparent and reports began to arrive at Mandan showing the injury had been widespread over the northern Plains.

Observations were made of a number of farm Chinese elm plantings during the summer of 1943. These observations together with several reports received from farmers and other interested parties form a basis

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for determining the extent and degree of injury. Observations made early in the season show the injury was more or less clearly defined as one of the following types: (1) Damage to tops only; (2) full or partial girdling of the trunk at varying heights above the ground with no injury to the tops; (3) killed to root collar; and (4) killing of both root and top.

At Mandan, trees 3 years of age suffered a 30 percent mortality, and the remaining 70 percent were killed to the root collar. Trees 4 to 30 years of age suffered less than 5 percent mortality, but about 40 percent showed more than the usual amount of winter injury. About 5 percent of the injured trees were killed to the ground.

Observations in western North Dakota during the summer show that 49 percent of the plantings suffered little more or no more than normal injury; 33 percent had severely killed back tops; 14 percent were killed to the ground; and 4 percent were dead entirely. Street trees in cities suffered approximately the same mortality and degree of injury. Trimmed hedges in cities suffered more severely with 90 percent of the trees in some localities killing to the ground. Reports from eastern North Dakota show a higher percentage of trees injured and the degree of injury was much more severe. The percentage and degree of injury and loss tends to show a decrease across the State from east to west.

Reports from South Dakota show that 50 percent of the trees were injured in that part of the State lying east of the Missouri River. Montana and Wyoming trees suffered varying de-

grees of injury which are not believed to be as severe as that in the states to the east.

There is fairly conclusive evidence that the injury to Chinese elm and other species of woody plants was caused by a combination of plentiful soil moisture and a sudden drop in temperature accompanied by snowfall during the period September 25-28, 1942. Chinese elm suffered very similar injury and loss in southern South Dakota, Nebraska, Kansas, and other states as a result of a sudden severe cold wave in November, 1940.

In North Dakota, precipitation during August, 1942, averaged 3.09 inches, and for September 1-24 the average was 1.29 inches. The favorable soil moisture conditions resulted in a vigorous growth being made, unchecked by sufficiently heavy freezing temperatures, when the temperature suddenly dropped between September 25-28, to a record low for the month of 4° F. accompanied by a record September snowfall. The snowfall varied up to 9 inches throughout North Dakota. Previous to September 25, only one or two points in the State had recorded temperatures sufficiently low to check growth of the late maturing species.

The minimum temperature of 4° F. during the cold wave was recorded at Parshall, North Dakota, with minimums in other parts of the State ranging from 10 to 22°. Late maturing species which were growing and which had not commenced to ripen when the cold wave came suffered rupturing of the cells and killing back to varying degrees. Some exceptions to this killing were observed at Mandan and later reported from other points in the State. Chinese elm grow-

ing in direct competition with a rank growth of weeds, sod, or other vegetation, or trees planted in dense stands or located on high, dry sites were found to have suffered much less injury than those trees growing on sites where the competition was absent or where soil moisture was more favorable. In adjacent blocks at Mandan, three-year Chinese elm of the same origin, age, and grown under identical conditions except for spacing distances, suffered 70 percent mortality in a block spaced 15 by 15 feet and 25 percent mortality in a block spaced 5 x 10 feet. Soil moisture studies made a few days prior to the cold wave showed available moisture in all foot sections to a depth of 10 feet in the block spaced 15 by 15 feet, whereas the soil was comparatively dry in the second, third, and fourth foot-sections of the block spaced 5 by 10 feet. Both blocks received clean cultivation during the season.

Only minor injury on Chinese elm was reported from Bottineau County, North Dakota. Weather Bureau records at Bottineau show the September 1-24 rainfall as 0.38 inch. The minimum temperature during the cold period of September 25-28 was 17° F. The lack of plentiful soil moisture had apparently resulted in the trees hardening somewhat in that locality.

In the vicinity of Carson, North Dakota, it was found by observations that many Chinese elm plantings escaped injury entirely and others showed only minor damage. Weather Bureau records at Carson show the September rainfall previous to the 25th as 1.82 inches. This was received in amounts of less than a quarter of an inch except for one

rainfall of 0.88 inch on the 17th. Temperature minima for the period September 23-27 were 28°, 21°, 11°, and 18°, respectively, with one freezing temperature previous to September 23 of 30°. This occurred on the 19th. In the observed plantings, the weed or sod competition as compared with other plantings was not sufficient to account for the lack of serious injury. The more gradual drop in temperatures in this locality may have tended to harden and mature the growth.

Further evidence that the September storm was responsible for the injury to woody plants was found at Mandan in the spring of 1943 when raspberries which had been covered with a heavy layer of soil in late October following the September storm were found to be killed to the ground. In this particular case there is little room for doubt that the injury occurred before the plants were covered with soil.

Favorable precipitation was received during the growing season of 1943, and recovery of injured Chinese elm trees was rapid. Trees which had been killed back in the tops only made considerable new growth from immediately below the injury. These will make good trees in the future. Trees which were completely girdled around the trunk killed back to below the girdling and are recovering by both stem and root sprouts. Trees partially girdled made normal growth in those branches supplied by the uninjured part of the stem. These trees may live for many years in satisfactory conditions as the species has a remarkable ability for growing new tissue from uninjured parts of the trunk which closes later-

ally over the injured areas. Trees killed to the root collar made excellent recovery by sprout growth from the collar. With corrective pruning practices, these will again make satisfactory trees.

Only a very minor percentage of trees killed to the ground in the spring were found to have died during the summer after having made some sprout growth from the root collar. This would indicate that little, if any, partial root-killing had taken place during the cold wave. Roots were either affected sufficiently to kill them entirely at the time or received no injury. In cities, many of the injured street trees were grubbed out and other species replanted in their place. Very few injured trimmed hedges were grubbed out or cut down and sprout growth from the base was sufficient to cover most of the dead wood. With corrective pruning and removal of dead wood, these hedges may give satisfactory service for several years.

The combination of plentiful soil moisture and the sudden drop to record low temperatures in September, which is held responsible for the injury to Chinese elm and other woody plants, is unusual. However, a somewhat similar set of climatic conditions was recorded in Mandan, in September 1926 when the minimum temperature for the month was 16° F. on the 24th. This was preceded by 31° on the 18th and 26° on the 23rd. In September, 1942, the minimum of 16° occurred on the 25th preceded by 31° on the 18th and 29° on the 23rd. September precipitation during the period preceding the date of minimum temperatures was 1.78 inches in 1926

and 1.86 in 1942. No mortality and very minor killing back was recorded on Chinese elm in the spring of 1927 as compared with considerable mortality and killing back in the spring of 1943. In the 51 years of Weather Bureau records for North Dakota, September temperatures have dropped below 20° in 33 years with the record low previous to 1942 being 8° F. The temperature has fallen to 15° or below in 20 years and to 10° or below in 8 years. During the past 25 years when Chinese elm has been planted on the northern Great Plains, September temperatures in North Dakota have dropped below 20° in 14 years; to 15° or below in 11 years; and to 10° or below in 5 years. There are no records of any unusual mortality or killing back of Chinese elm during this 25-year period.

During the storm of September 1942 Weather Bureau records for North Dakota show the ground froze to a depth of 3 inches in a few localities, gardens were destroyed, and considerable corn and late flax was damaged.

Inasmuch as climatic conditions in September 1942 apparently combined to create an unusual condition, it is not believed that the resulting injury to Chinese elm is sufficient to justify recommendations which would outlaw the planting of this species in the future. Low September temperatures of many previous years have caused little or no damage. As a result of the 1942 climatic conditions, other commonly planted species such as Russian-olive, hackberry, American elm, green ash, and other trees, shrubs, and fruits were as severely injured as the Chinese

elm in certain areas. There is no record of those species having suffered such serious injury in previous years.

Avoid exclusive use of Chinese Elm

In past years the Mandan Station has recommended that Chinese elm form not over 15 to 20 percent of the composition of any tree planting owing to its late maturing habit. It is believed this recommendation will hold true for future use of the species. **The planting of the species in pure stand such as has been practiced by many planters in the past is definitely not recommended. Very restricted use should be made of it for boulevard plantings as it has several undesirable characteristics for this purpose in addition to its late maturing habits. For**

trimmed hedge purposes other earlier maturing and more desirable species are available which should be planted in preference to Chinese elm.

Public reaction to the killing back and mortality of Chinese elm has not been entirely unfavorable. More unfavorable comments have been received from city people who have only a few trees than from farmers who have greater number and other species. The injury and mortality may have tended to eliminate at least temporarily, the very late maturing and less hardy strains. It will also give an opportunity during the next two or three years to collect seed from uninjured trees, which may tend to build up earlier maturing strains less likely to be injured by early fall freezes.

How to Hasten Fall Maturity of Chinese Elm

Present and future growers of Chinese elm may well adopt any practices that will hasten fall maturity. Some suggested practices follow: Irrigation of Chinese elm should not be practiced between the middle of August and the time of the first freeze of sufficient intensity to check growth; (irrigation may be practiced after growth activities cease and before the soil becomes frozen); when abundant moisture is received in late August and through September, weeds should be permitted to grow among the trees to reduce the available soil moisture; (this practice is not recommended in dry falls); future plantings of the species should be confined to the drier sites; the species should not be planted in depres-

sions receiving run-off moisture or on sites having a high water table.

Chinese elm has been extensively planted and enjoyed by many people on the northern Plains during the past 15 to 20 years. If used in conjunction with other species in limited amounts rather than in more or less pure stand, and if grown on sites and cared for as recommended, present data fully justify the planting of the species in the years to come.

Tree planters on the northern Plains, where sudden drops of temperature and sleet storms may be expected early in the fall, and where soil moisture is usually very limited, should learn that the hardy trees are not the ones which leaf out early

in the spring and retain their leaves late in the fall, but rather the reverse is true. While early leafing out in the spring and late retention in the fall is highly desirable from the esthetic point of view, and is the standard by which many people select a species, the possibilities of sev-

ere breakage and injury by climatic elements such as sleet storms and early freezing temperatures are so great that species of these types should be used only sparingly and in conjunction with other more conservative ones.

Reprints of this article are available.

The effect of seed treatment upon the emergence of low germinating barley. During the season of 1943 W. E. Brentzel, Plant Pathologist, tested the effect of four different seed disinfectants upon the field emergence of three different lots of Wisconsin No. 38 barley with the following results.

Disinfectant Used	Sowed seed of 98% germination	Sowed seed of 76% germination	Sowed seed of 73% germination
Ceresan	86% emergence	78% emergence	75% emergence
Spergon	75% emergence	70% emergence	57% emergence
Arasan	76% emergence	71% emergence	60% emergence
DB 1452	86% emergence	72% emergence	73% emergence
Seed not treated	84% emergence	72% emergence	57% emergence

Spergon and Arasan did not increase the emergence of barley in these tests and Ceresan caused only a slight increase.

The role our birds play as guardians of crops is an important one. Their beneficial habits of feeding upon great numbers of injurious insects and other crop enemies are often underestimated. This bulletin discusses in popular language the economic relationships of some 50 species of birds, many of which occur in North Dakota and directly influence our agricultural economy. It is of interest that the crow was included among those birds as "useful to the farmer." The author bases his conclusions on the fact that insects comprise approximately 1/5 of the normal food of the crow, and among those insects commonly taken were grasshoppers, wireworms, weevils, white grubs and caterpillars, and that although corn is frequently eaten, over 60 percent is consumed from the first of November until the end of March and could thus be considered as waste. The crow is not entirely vindicated, however, since the author states, "The 'pulling' of corn is a trait most prevalent in small field areas. Wheat and oats suffer similar damage at times . . . About the only safeguard to ripening grain is the constant use of powder and shot or the scarecrow." Some Common Birds Useful to the Farmer by F. E. L. Beal, Conservation Bulletin 18, Fish and Wild Life Service, U. S. Dept. of Interior. (Review by H. S. Telford).