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## Bulletin No. 11: A Roadside Crisis: The Use and Abuse of Herbicides

Richard H. Goodwin

William A. Niering

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# THE CONNECTICUT ARBORETUM

## A ROADSIDE CRISIS: THE USE AND ABUSE OF HERBICIDES

CONNECTICUT COLLEGE  
NEW LONDON, CONNECTICUT



BULLETIN NO. 11  
MARCH 1959

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## ARBORETUM STAFF

*Director*, RICHARD H. GOODWIN

*Horticulturist*, JOHN STENGEL

*Assistant Director*, WILLIAM A. NIERING

*Collector*, KALEB P. JANSSON

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Checks should be made payable to Connecticut College and sent to the Director, Dr. Richard H. Goodwin, Connecticut College, New London, Conn.

## Acknowledgments

This bulletin is an outgrowth of a growing concern on the part of the Arboretum staff in regard to the misuse of herbicides on our roadsides. We were privileged to attend a conference on problems related to the use of herbicides along the highways called by Dr. James G. Horsfall, Director of the Connecticut Agricultural Experiment Station. Present at the meeting were Dr. Horsfall, Dr. A. E. Dimond, Dr. E. H. Stoddard and Dr. John F. Ahrens, all of the Experiment Station, Mr. Leonard P. Bradley, President of the Connecticut Botanical Society, Mr. John L. Wright, Engineer of Roadside Development and Mr. William C. Greene, Landscape Engineer, both of the State Highway Department. This conference was very helpful to us in drawing up the recommendations set forth in this bulletin. We are grateful to several commercial concerns for demonstrating various types of herbicide techniques. We wish to thank the following men for reading and criticizing drafts of the manuscript: Dr. John F. Ahrens, Dr. Frank E. Egler, Mr. William C. Greene, Dr. Roger P. Wodehouse and Mr. John L. Wright. Although we have attempted to incorporate the many suggestions which have been offered, the authors take full responsibility for the ideas expressed.

RICHARD H. GOODWIN, *Professor of Botany*

WILLIAM A. NIERING, *Associate Professor of Botany*

## The Purpose of this Bulletin

In the United States almost every family has one or more cars, and a vast number of hours is spent on the road commuting or driving for pleasure. Thus we can truly be described as a nation on wheels. The construction and maintenance of highways has become a major item in the national economy; their safety and aesthetic appearance are matters of public concern.

The vegetation along the shoulders of our highways and roadsides is essential to the right-of-way both as a stabilizer of the soil and as a pleasant and restful margin to the countryside beyond. The management of this vegetation presents a series of important maintenance problems, involving appreciable portions of our highway budgets.

The discovery of herbicides—chemicals which effectively, and in some cases selectively, eliminate plants to which they are applied—has provided a powerful and economical tool with which to manipulate the vegetation. Like many other new developments their use may be of great public benefit, but their abuse may lead to unfortunate consequences. The indiscriminate application of herbicides to thousands of miles of our roadsides has resulted in the unnecessary elimination of many of our beautiful native shrubs and wild flowers. The matter has become sufficiently serious to suggest the title to this bulletin, "a roadside crisis."

We feel that herbicides should be used with discrimination, keeping the various objectives in mind—safety and health of motorist and pedestrian, the beauty and interest of the roadside and the economy of highway maintenance. The purpose of this bulletin is to present constructive suggestions for the correction of some of the abuses of herbicides. It should be emphasized that there are many types of roadside situations and that methods should be intelligently adapted to each particular situation.

Highway departments are anxious to give the public good service. Some of them are spending large sums of money on ornamental plantings and even on research as to the best methods of re-seeding native species along our roadsides. It seems pathetic that these efforts should be negated by the improper use of herbicides. It is the duty of the highway department to do the best job it can, and the civic responsibility of the enlightened citizen to see that this performance is up to standard.

*Richard H. Godwin*  
Director

# The Management of Roadside Vegetation by Selective Herbicide Techniques

RICHARD H. GOODWIN AND WILLIAM A. NIERING

THIS PAPER deals with problems resulting from the improper application of weed killers to our roadsides and recommends ecologically and economically sound management techniques. The recommendations have general applicability, but are especially directed toward two-lane town, county, and state roads. They do not apply to the maintenance of the frequently mowed grassy turf on parkways or to areas under guard rails, where it may be desirable to eliminate the vegetation completely.

## What is the Crisis?

1. Needless destruction of attractive roadside native shrubs and small trees,<sup>1</sup> and wild flowers and other herbaceous flowering plants frequently referred to as "noxious weeds",<sup>2</sup> which, if spared, would enhance the beauty of the roadside.
2. Inadequate root-kill of the sprayed trees and shrubs (brush) on initial application so that repeated treatments are required.
3. The spraying of ragweed in the infrequently mowed areas several feet or more back from the margin of the pavement. Here this technique is biologically unsound as a method of control since it has the unfortunate side effects listed under item one above.
4. The unnecessary creation of continuous unsightly brown swaths along roadsides, which results from broadcast spray techniques.
5. Attractive low price-per-mile-per-spray bids offered by

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<sup>1</sup> Azaleas, mountain laurel, blueberries, huckleberries, dogwoods, viburnums, bayberry, sweet fern, winterberry, chokeberries, wild plum and others.

<sup>2</sup> Daisies, black-eyed susans, Queen Anne's lace, chicory, goldenrods, autumn asters, etc.

spray contractors careless of desirable plant types being sprayed. A quality job requires a considerably higher initial expense *but is an economy in the long run* because of the far more effective results obtained with each treatment.

Here are a few examples of the flagrant abuse of herbicides that have come to our attention. Along the narrow woodland roads of a mid-western state forest the roadsides have been indiscriminately sprayed to a depth of 16 feet. Extensive stands of pinxter azalea, blueberries, native ferns and wildflowers have been thereby destroyed.

In a southern New England town a spray contractor finished his assignment with extra material in his tank. He discharged the contents along woodland roadsides unauthorized by the town selectman. This resulted in the elimination of the usual attractive fall wildflowers along these roads.

A New England state highway department set up specifications for roadside spraying in a state-aid program. The company receiving the contract on the basis of the lowest bid changed the state specifications from a maximum height of four feet to one of eight feet without the knowledge of the highway department. The disfiguring nature of the application and the unnecessary increase in the damage to the vegetation further back from the road was thereby greatly aggravated.

### **Roadside Needs.**

1. Adequate visibility for the motorist, which necessitates removal of certain woody growth along the roadsides, especially at intersections and the insides of curves.
2. Adequate space for pedestrians and areas where motorists can safely pull off of the travelled pavement.
3. The eradication of poison ivy, poison sumac, and any other plants specifically known to be undesirable in regard to human health and maintenance procedures.
4. A roadside attractive to the motorist, whether he be on vacation or merely commuting to and from work.
5. The accomplishment of the foregoing objectives at a minimum cost, figured on a long-range basis.



## A Selective and Economical Approach to the Problem

THE SELECTIVE APPROACH implies the elimination of only those plants which obstruct vision, interfere with other highway functions or are deleterious to human health. This involves treating the undesirable woody plants selectively rather than by non-selective broadcast or blanket spray techniques now commonly employed, since the latter will damage or kill *all* the desirable woody species as well as those to be eliminated. It also involves carefully restricting the use of herbicides to that portion of the herbaceous cover which requires attention.

- A. *Management of the mowed strip.* Along most roadsides there is a mowed strip of varying width, behind which is frequently found a brushy margin dominated by a mixture of trees and shrubs. This mowed strip is not to be confused with the frequently-mowed turf areas along parkways. The *selective* use of herbicides may be useful in eliminating woody plants from this strip (see paragraph B below). Once established it will consist of perennial grasses and broad-leaved flowering plants which may be maintained by occasional mowing. *The broadcast use of herbicides should be avoided in this zone.* For an exception see paragraph D below. The mowed strip should be wide enough for the safety of pedestrians, and may provide wider spaces here and there for cars to pull off of the travelled pavement as the need may require. An undulating or irregular margin for the woody vegetation will enhance the attractiveness of the roadside where this effect can be achieved.
- B. *Management of Roadside "Brush."* The mowed strip is often narrow along town roads with the "brush" (trees and shrubs) encroaching right to the edge of the road. Since tree sprouts, which occur in clumps as a result of previous cutting, often obscure visibility, and their branches tend to grow out into or lean over the road, it is a common practice to eliminate such tree growth. However, the *associated shrubs need not be eliminated*, unless they interfere with sight line conditions by their occurrence in the mowed strip immediately next to the road or on the inner sides of curves (see figure 1).

By employing this selective approach, many attractive broad-leaved flowering plants frequently referred to as "nox-

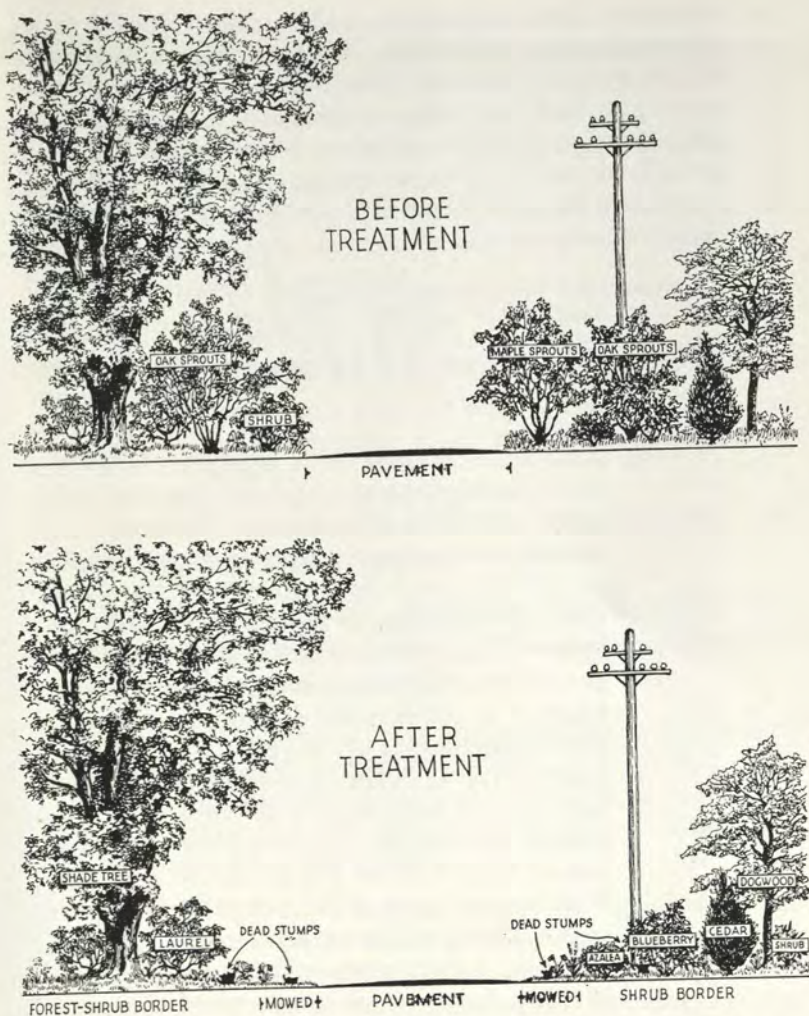


Figure 1. Diagram of roadside vegetation before treatment (above) showing tree sprout clumps and shrubs, some of which will be removed; and after treatment (below) with the undesirable woody plants selectively removed by herbicide treatment. Attractive native shrubs and wildflowers remain. Tree species which would grow into the wires of the utility lines have been removed. Shrubs underneath the wires and small trees adjacent to it have been preserved.

ious weeds," such as Queen Anne's lace, chicory, Joe Pye weed, milkweed, asters, goldenrod, etc., are preserved to enhance the beauty of the roadside. Ferns and woodland wildflowers would also be in this category. Obviously, in agricultural regions those plants which actually are troublesome to the adjacent landowners may be sprayed or controlled by other appropriate techniques. Elsewhere, this is not only unnecessary but often undesirable.

Recommended management techniques follow:

1. **SELECTIVELY TREAT UNDESIRABLE WOODY PLANTS** using one or a combination of the following techniques:

- a. *Basal Spray*. If undesirable vegetation is less than 4 to 5 feet high this technique is applicable, and excellent root kill can be expected. An effective formulation comprises a mixture of 2,4,5-T herbicide in fuel oil (12-16 lbs. chemical per 100 gals. of fuel oil). The spray is applied to the basal 12-18 inches of the stems, soaking thoroughly at the ground line. Application is usually made when the brush is in the dormant condition, but it can be made at any season of the year.
- b. *Stump Spray*. If undesired stems are over 4 to 5 feet high, it is recommended to cut them and treat the stumps. An effective formulation comprises a mixture of 2,4,5-T in oil (16-20 lbs. per 100 gals.). The tops and sides of the stumps should be thoroughly soaked to get run-down to the root collar. Large volumes must be applied to get good results. If stumps have been cut several months previous to treatment, axe frills encircling the stump will increase the effectiveness of the treatment.
- c. *Stem-Foliage Sprays*. **CAUTION.** *This technique can be readily abused unless carefully supervised. Special equipment is needed including a movable boom and bucket mounted on a truck. A trained operator rides in the bucket above the vegetation*

and selectively sprays only the undesirable woody species. Such equipment is commercially available, at least in Connecticut. Only late summer spraying of low growth is recommended in order to minimize brownout, but even then some browning of the vegetation results, especially if there are no desirable species to be saved. Since root-kill is less effective by this technique, several applications will be necessary.

Following clearing, undesirable sprouts *not exceeding 4 feet in height* can be stem-foliage treated in late summer with a mixture of 2,4-D and 2,4,5-T low volatile esters in water (4 qts. of 2,4-D and 2,4,5-T mixture; 1 qt. 2,4,5-T; in 100 gals. of water).

2. AVOID INDISCRIMINATE BROADCAST OR BLANKET SPRAYS.
  3. DO NOT SPRAY SHRUBS UNLESS THEY INTERFERE WITH VISIBILITY or need to be eliminated for other valid reasons.
- C. *Poison Ivy Treatment.* Poison ivy can be specifically sprayed during the summer with amino-triazole (Amitrol) or 2,4,5-T, following the directions prescribed on the label, or treated during the winter by a bark spray using the 2,4,5-T formulation given above for "basal spray."
- D. *Ragweed Eradication.* Ragweed, being an annual plant, requires open soil for its seedlings to become established each year. Therefore, by creating a dense continuous cover of other species (perennial grasses and broad-leaf flowering plants), ragweed is eliminated for as long as the cover remains intact. At the edge of the pavement and in other areas receiving continuing disturbance the establishment of dense perennial vegetation may be prevented. Whenever mowing cannot be sufficiently frequent, a light foliage spray *confined to this narrow strip* may, under certain circumstances, be useful as an annual and temporary procedure in controlling ragweed.

Recommended management techniques for ragweed.

1. ENCOURAGE DENSE COVER of perennial grasses and broad-leaved flowering plants in the mowed strip whenever possible. On sterile sites where other plants will not grow, improvement by fertilizer and/or topsoil is economically sound.
2. MOWING, especially during late summer prior to the flowering of ragweed, is recommended. This will prevent pollen formation of any ragweed which may still be present in the mowed area.
3. AVOID FOLIAGE SPRAYS any further back from the margin of the pavement than necessary. Such a spray kills the ragweed that particular year, but the soil is opened up and exposed for ragweed seed to grow there in subsequent seasons. It may even be more abundant following treatment, since the broad-leaved perennials are very sensitive to the spray and will be eliminated, thus exposing more soil for ragweed.
4. THE BEST WAY TO CONTROL RAGWEED IS TO ENCOURAGE OTHER PLANTS TO CROWD IT OUT.

**The Accomplishment of these Techniques:**

1. Only the undesirable woody species are removed.
2. Attractive native plants are preserved to enhance the roadsides, and these will tend to hinder the reinvasion of undesirable species.
3. Unsightly brown swaths are minimized or eliminated.
4. Ragweed is controlled by eliminating the sites suited for it.
5. Fewer treatments will be needed to accomplish the objectives, since better root-kill is obtained. The initial cost of the selective treatment will be higher than that for indiscriminate sprays. However, if one is interested in a high quality maintenance operation involving the points mentioned above, this approach is cheapest and of greatest public benefit.

# A Potential Danger of Broadcast Sprays

WILLIAM A. NIERING

THE PURPOSE of this report is to describe a specific case of the improper use of herbicides in which serious damage to shade trees resulted from a broadcast spray treatment of the roadsides and poor results were obtained from the point of view of maintenance. During the spring of 1957 the town of Waterford sprayed the brush along its roadsides with chemical weed killers. The technique employed was observed by the writer, and the chemical formulation was obtained from the town officials. The chemical applied was a mixture of 2,4-D and 2,4,5-T herbicide (2 quarts 2,4-D and 1 quart 2,4,5-T per 100 gallons of water). This combination of low-volatile esters was applied in a broadcast spray to both trees and shrubs up to a height of 4 to 6 feet along the town roads. The equipment used was a power sprayer operated from a jeep pickup with an extension hose operated by a person standing on the moving vehicle.



Figure 1. Drift effects of indiscriminate foliage spraying along Gallows Lane, Waterford, Connecticut. Left, white oak twigs showing a pronounced weeping effect eighteen months after treatment. Right, white oak leaves abnormally curled and deformed compared to normal specimens at the right, photographed at the end of the first growing season.

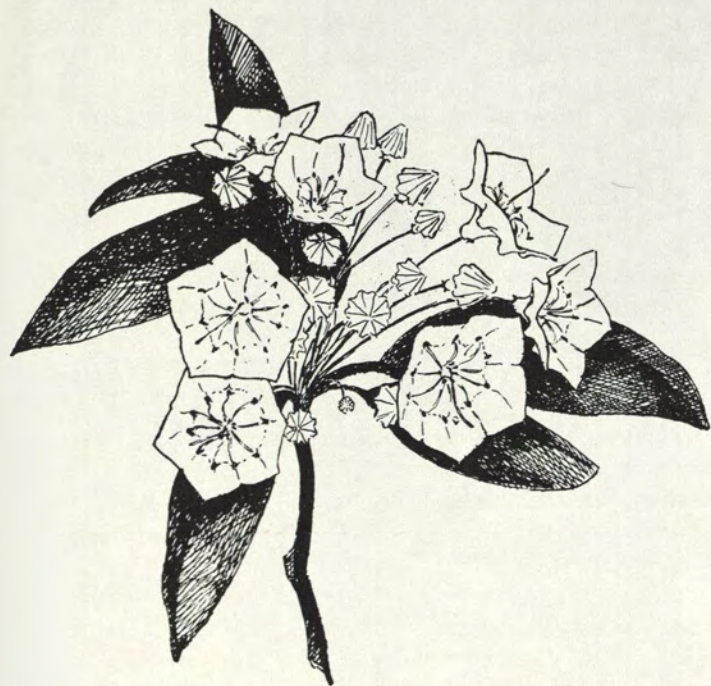
As these marginal strips slowly turned brown, more pronounced effects to adjacent unsprayed trees were noted. Large oak trees over-arching the road soon showed leaf curling as the spring growth appeared (Figure 1). White oaks 1-2 feet in diameter were seriously affected with most of the leaves turning brown. Scarlet and black oaks of similar size showed pronounced leaf curl. As the summer progressed new leaves appeared on the white oaks, but die-back of the new shoots and curled leaves persisted throughout the summer. Although most of these observations were made on Gallops Lane, which runs through part of the Connecticut Arboretum, similar effects were noted wherever the spray had been applied along the town roads. Trees well within the boundaries of the Connecticut Arboretum Natural Area were seriously injured. Certain branches 12-15 feet above the sprayed strip were practically bare. New shoot growth in some cases was abnormally rapid giving rise to a drooping or weeping habit (Figure 1). These effects were not restricted to the roadside, since trees were thus affected up to 300 feet back from the point of application.

What factors are responsible for these adverse effects? Highly volatile chemicals have been known to cause this type of damage. However, the chemicals used in this case have been tested and are of low volatility. Apparently the mode of application was responsible. The spray was applied at about 80 pounds pressure, at least 30 pounds more than is recommended, and nozzles were used that produce a very fine atomized broadcast spray which tends to drift easily, even in the slightest breeze.

An analysis of the results of the indiscriminate spraying after two growing seasons, reveals a high survival of the tree sprouts in the specific strip treated. Sweet birch and certain shrubs were most sensitive to the treatment. The ineffectiveness of the broadcast spraying is indicated by the need for cutting the undesirable growth along the town roads one year after treatment.

On the other hand, what has been the effect on the larger trees which were unsprayed but which exhibited leaf curl the summer following the spraying? Large branches on these trees have died, and portions of the trees were without leaves during the second summer. On trees where the weeping effect occurred, new growth was stunted the following season. The deformed weeping effects still persist.

After this incident any spraying done by the town will be on a selective basis. Two reasons are behind this change in policy—poor results from broadcast spraying and the adverse public reaction to the improper use of chemicals on the initial application.





# Approaches to the Connecticut Arboretum

