

WHEREVER ornamentals are grown, weeds present big maintenance problems. Costs of hand labor for weed removal in nurseries in the Northeast, for example, may average close to \$200 per acre per year where the weeds are systematically removed. Where weeds are unduly neglected, the cost of a single hoeing can approach this figure. Although costs of weed control by hand or mechanical methods in parks or estates are not well known, it is reasonable to assume that they represent a substantial portion of the maintenance budget.

It has been demonstrated in many nurseries that replacing hand methods of weed removal with chemical weed killers alone

faster growing weeds that are sure to get a lion's share of nutrients and water. In some experiments in ornamental plants, chemical control of weeds that harbor parasitic nematodes also has decreased the nematode populations. The net result of chemical weed control, then, can be measured in increased plant vigor and growth, often 50% better than plants hoed periodically as in normal nursery practice.

As one might expect, there is no one herbicide that controls all weeds safely in every ornamental situation. The herbicide must be chosen for both the crop and the weed involved. The big problem in ornamentals is that there are numerous species, varieties, and sizes of ornamentals

Herbicides for ornamentals are discussed in this article under three categories: (a) herbicides for preemergence weed control; (b) herbicides for postemergence weed control; and (c) herbicides for problem weeds. In general, preemergence treatments prevent weeds from becoming established and postemergence treatments kill weeds after they are established. Some herbicides have pre- and postemergence activity.

#### Herbicides for Preemergence Weed Control

The herbicides most useful in ornamental plantings are the soil-applied preemergence herbicides—compounds that kill weeds in their early stages of

## Present and Future Uses of Herbicides in Ornamentals



can reduce costs of maintenance by 50% or more.

The injury ornamental plants sustain from mechanical or hand methods of weed control may be ignored but nevertheless adds greatly to the cost of producing ornamental plants. Field examinations of saleable woody nursery stock have indicated that few plants escape eventual barking from the hoe or cultivator. The right herbicides properly used greatly decrease the hazard of plant injury and mortality.

Still other benefits can derive from chemical weed control in ornamental plants. Better utilization of fertilizer by ornamental plants occurs where weeds are prevented with herbicides. Since most ornamentals are by nature slow growing, they offer little competition to the

that vary greatly in their tolerance of herbicides. Without trial evaluations, it is dangerous to assume that a plant is tolerant of a particular herbicide. Although, generally speaking, woody plants are more tolerant of soil-applied herbicides than are herbaceous plants, and larger, better established plants are more tolerant than are smaller or newly set plants of the same species, it still is wise to use any herbicide on a trial basis the first time it is used in a particular planting. This includes leaving an untreated comparison, even though the herbicide may be labelled for the particular plant type.

germination and growth but usually do not kill established plants or weeds. To be effective they must be applied and become activated before weed seeds germinate. Many preemergence herbicides that are used in other crops could be useful in ornamentals but the most promising are those possessing long residual activity in the soil.

*Simazine* (2-chloro-4,6-bis-ethylamino-s-triazine, available as wettable powder or granules), currently is the most widely used herbicide in ornamental plantings. One of the reasons for its wide use is that it can be applied in either the wettable powder or granular form during any season of the year. Fall or winter applications of simazine at 2 to 4 lbs. per acre can be expected to pay the greatest dividends to

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nurserymen because established chickweed (*Stellaria media*) is killed, and most weed growth is prevented until June or later. In the Northeast, fall or winter applications at these rates do not usually affect the growing of an oat cover crop the following September, an added advantage where winter erosion is a problem. Cultivation slightly reduces the effectiveness of simazine for annual weed control, but may be essential if a dry period follows application and weeds escape injury.

As well as controlling most annual weeds, with the possible exception of crabgrass (*Digitaria spp.*), at low rates of application, simazine also controls many per-

*zia gracilis*, *Rosa rugosa*, *Philadelphus*, *Ligustrum*, and *Hypericum*. Unlike *Rosa rugosa*, most of the rose family appears to be highly tolerant of simazine. Since tolerance depends somewhat upon soil type and plant size, several of the above plants have tolerated low rates of simazine without ill effects. Woody plants showing mild discoloration by simazine have made better growth than untreated weed-free plants in some experiments.

Several narrow-leaved evergreens have demonstrated very high tolerance to simazine and newly set field liners often are treated by nurserymen in the Northeast. Exceptions to this rule are hemlocks (*Tsuga cana-*

of simazine and on a few that are susceptible to injury from simazine if sprays are directed to avoid hitting the plant foliage. With overhead sprays of neburon, discoloration has occurred in deciduous species such as *Forsythia*, *Philadelphus* and *Spiraea* and the evergreen *Tsuga canadensis*. However, dormant overhead applications of neburon are much safer.

At 4 to 6 lbs. per acre, neburon controls many annual weeds and grasses for 2 to 4 months and also is effective against established chickweed in the fall or spring. Applied on the same nursery areas for 6 years, neburon has caused no injury to newly planted or established *Taxus spp.*, *Euonymus sarcoxie* or *Picea glauca*.

CIPC [isopropyl N-(3-chlorophenyl) carbamate] has been used in nurseries for many years. It is safe for use in many species of woody ornamentals and some perennials when applied at 4 to 8 lbs. per acre in granular form or as a directed spray. CIPC is at its best during the cool seasons and can be used to kill established chickweed in azaleas, for example. Warm-season weed control often lasts only 4 to 6 weeks with CIPC and repeated applications are required for longer weed control. Soil disturbance after application decreases the effectiveness of CIPC. It's available as chloro IPC in emulsifiable or granular form.

DCPA [2,3,5,6-tetrachloro-terephthalate] first emerged a few years ago as a crabgrass killer for lawn turf, and now is labeled for use in a wide variety of herbaceous and woody ornamental species, including some newly seeded or newly planted annuals and perennials. Owing to its wide tolerance among ornamentals as well as its proven effectiveness for crabgrass control in turfgrass, DCPA should prove to be a boon to custom applicators and to landscape nurserymen who often grow a mixed variety of ornamentals in the same field. At rates of 9 to 12 lbs. per acre, DCPA is most effective against annual grasses but also controls a number of annual broad-leaved weeds including purslane, lambs-

ennial weeds including quackgrass (*Agropyron repens*) at higher rates of application. This is especially true where simazine is applied prior to quackgrass emergence and is combined with cultivation. Annual weed control with simazine may last from 2 months to a season, depending upon the rate of application.

Simazine has been safely used on most established field-grown woody plants (those planted for 6 months or more before application) and certain deep-rooted perennials or bulbs such as peonies and tulips and ground covers such as *Vinca* and *Pachysandra*. Woody plants that have been injured by simazine include *Azalea*, *Euonymus*, *Forsythia*, *Salix*, *Spiraea*, *Lonicera*, *Syringa*, *Deut-*

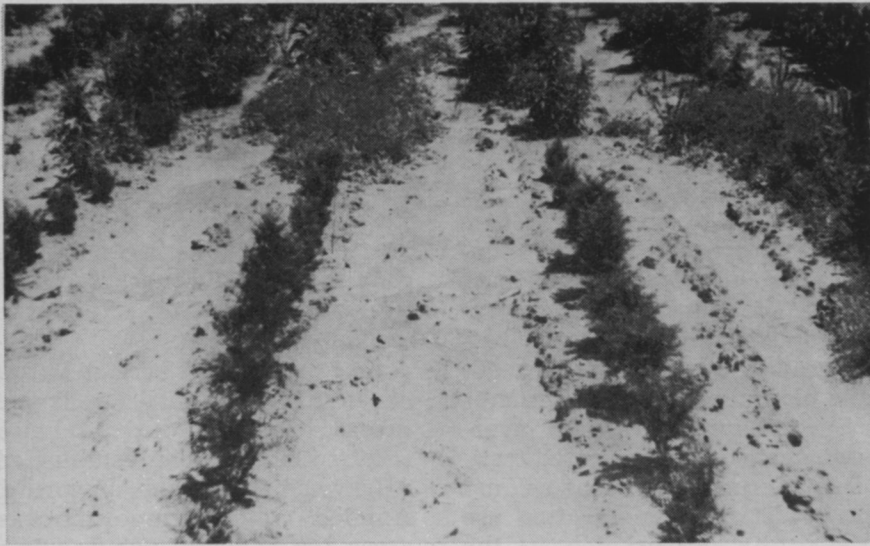
*densis*) and *Taxus cuspidata capitata*. Best results can be expected where the plants are well set and have received a good rain or irrigation before treatment. In smaller plants or newly set plants, the low rates of application (1½ to 2 lbs. per acre) used often provide acceptable weed control for 2 to 3 months.

Other preemergence herbicides labeled for ornamental and nursery plantings, some of which are not tolerant of simazine, include neburon, CIPC, DCPA, dichlobenil, and trifluralin.

Neburon (1-*n*-butyl-3-(3,4-dichlorophenyl)-1 methyl urea, available under trade name "Kloben" as wettable powder), can be safely applied on most of the woody nursery species tolerant



A permanent nursery where herbicides may be tested for effectiveness in ornamental plantings is a feature of the Connecticut Agricultural Experiment Station. Photo was made about 9 weeks after 6th annual application.



A dormant application of granular simazine controls weeds for several months, author Ahrens says.

quarters, and chickweed. Like simazine, DCPA can be sprayed directly over plants or applied in granular form. One of the promising treatments of the future for ornamental plantings may well include a combination of DCPA with simazine or some other broad-spectrum weed killer. Applicators may obtain DCPA under trade name of "Dacthal," as wettable powder or in granules.

*Dichlobenil* [2,6-dichlorobenzonitrile] and *trifluralin* [a,a,a-trifluoro-2,6-dinitro-*N,N*-dipropyl-*p*-toluidine] are relatively new preemergence herbicides that are now labeled for use in ornamental plantings. Both have little foliage activity and can be sprayed directly over growing plants, and both have longer residual activity in the soil when incorporated. *Dichlobenil* promises to be useful primarily during the cool season because it is somewhat volatile under higher temperatures. Dormant applications of *dichlobenil* at 4 to 6 lbs. per acre control established sods including quackgrass. During the growing season *dichlobenil* appears to be effective against several annual weeds and some perennials including nutsedge (*Cyperus spp.*) for 2 months or more. Incorporation of *dichlobenil* may be required for best results on nutsedge. Commercially, the compound is known as Casoron, and is available as wettable powder or in granular form.

*Trifluralin* is effective at rates of ½ to 2 lbs. per acre when incorporated into the soil, or 3 to 6 lbs. per acre when used as a surface spray. It has long residual activity especially against grassy weeds and has been used safely over certain established annual and perennial flowers as well as woody plants. *Trifluralin*, called "Treflan," is available in emulsifiable form.

Since no single herbicide controls all weeds in all ornamental crops it is inevitable that herbicide combinations will be used to a greater extent in the future. Since simazine has long residual activity against broad-leaved weeds at low rates of application, it could be combined with herbi-



In deciduous plantings, such as these maples, a directed application of amitrole plus simazine kills established weeds and prevents further weed infestation for very long periods.

cides such as DCPA or trifluralin that have long residual activity against grasses. Other preemergence herbicides are currently being tested in ornamental plants, and one of these new materials (diphenamid) looks very promising alone or in combination with low rates of simazine. Since the writing of this article diphenamid has been labeled for use on nursery stock. Diphenamid, called "Dymid" and "Enide," comes as a wettable powder or in granular form.

### Herbicides for Postemergence Weed Control

To control most established weeds, it is necessary to use a foliage-active herbicide. The one that has found the most usage in ornamental plantings is a combination of amitrole [3-amino-1,2,4-triazole] and simazine, applied as a directed spray around the base or between the rows of woody plants (Amitrole is available as a powder or liquid under several trade names). A combination of 1 lb. of amitrole plus 3 lbs. of simazine usually produces rapid kill of actively growing weeds and prevents most weed growth for a growing season. This combination kills faster than either amitrole or simazine alone and also provides long residual weed control. The combination, known as Amizine, can be used only where a directed spray is feasible and only around established species that tolerate simazine.

*Solan* [3-chloro-2-methyl-*p*-valerotoluidide] is safe and effective as an overhead spray during the dormant season on many species of deciduous nursery stock or as a directed spray during the growing season. *Solan* at 4 lbs. per acre is effective against seedling grasses less than 1 inch high and seedling broad-leaved weeds 2 inches high including established chickweed. Since it has no residual activity in the soil, repeated applications of *solan* are required during the growing season. *Solan* is cleared for use as a directed spray in greenhouse-grown carnations and roses as well as in woody ornamentals outdoors. Its trade

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name is also Solan, and it comes in emulsifiable form.

### Herbicides for Problem Weeds

Mugwort (*Artemisia vulgaris*) and quackgrass are two of the most serious perennial weeds of ornamentals. Where high value crops are to be grown in soil infested by these weeds, eradication with soil fumigants such as methyl bromide, SMDC (Vapam or VPM, [sodium-N-methyl-dithiocarbamate]), DMTT (Mylone [3,5-dimethyltetrahydro-1,3,5,2H-thiadiazine-2-thione]), or methyl isothiocyanate (Vorlex) should be considered. However, many infestations are in established plantings where this is not feasible. Directed sprays of amitrole at 6 to 8 lbs. per acre repeated after 2 or more months have been somewhat effective against mugwort. More recent work indicates that EPTC (ethyl N,N-di-n-propylthiolcarbamate) at 4 to 6 lbs. per acre incorporated into the soil and reapplied after 2 months also can be effective against both species. EPTC is safe for use on many of the ornamentals not tolerating simazine and also controls nutsedge, another problem weed in some areas. Known as Eptam, EPTC comes in granular or emulsifiable form.

Dormant application of granular dichlobenil also has appeared promising for the control of quackgrass and mugwort in nursery plantings.

On simazine-tolerant species, quackgrass can be controlled by increasing the rates of simazine application to 4 to 6 lbs. per acre and cultivating occasionally. Dormant applications of simazine appear to be more effective against quackgrass than applications during the growing season.

Several preplanting herbicide treatments have been very promising in Connecticut tests and could be used in fields infested with quackgrass where the expense of fumigation is not justified. In fields to be planted to narrow-leaved evergreens or other simazine-tolerant plants, excellent results have been obtained with fall applications of atrazine at 2 lbs. per acre or simazine at 3 lbs. per acre, followed by spring plowing and planting and a subsequent application of 2 to 3 lbs. of granular simazine. This treatment provides excellent control of annual weeds as well as quackgrass.

### Some Considerations in Using Herbicides in Ornamentals

More than with fungicides and insecticides, it is important with herbicides to obtain uniform and accurate applications. This is so mainly because dosages of herbi-

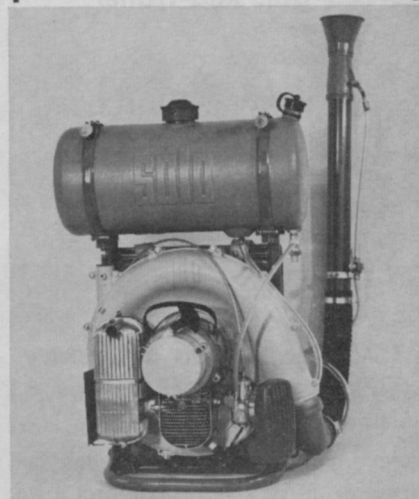


An application of simazine at 3 lbs. per acre in March kept the area in the foreground weed free well into June.

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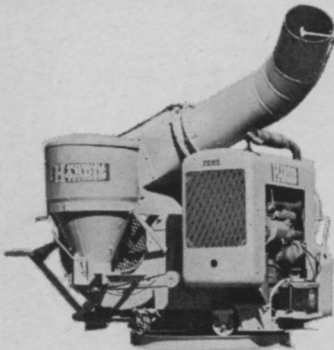
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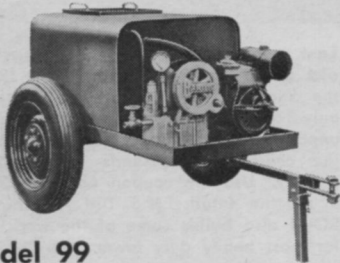
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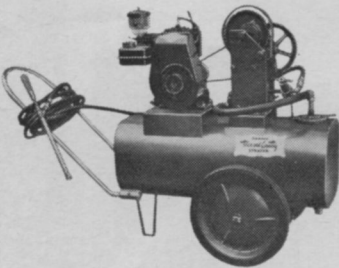
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cides are more critical for satisfactory weed control without injury to valued plants. Weed seeds do not move in the soil, and the correct dosage of herbicide must contact the roots of a seedling as it germinates; a severe overdosage may kill or injure the ornamental plant. Calibration of equipment, therefore, is a must. Using nozzles equipped with a check valve also can prevent injury to plants when the sprayer is stopped in the field or moving across a lawn area.

It is impossible to state accurately the herbicide dosage that will be needed to control weeds at all locations. However, instructions on the herbicide label usually indicate the range of dosages for given conditions. Soil organic matter and clay colloids that adsorb herbicides and render them nontoxic to weeds vary greatly from one area to another. Therefore, lighter soils low in organic matter generally require lower rates of herbicides than heavier soils higher in organic matter. On light sandy soils, the danger of herbicides leaching to the root zone of ornamental plants also is greater; therefore, herbicide dosages should be lower.

Erosion can sometimes be a problem where herbicides are used to control weeds on slopes. This can result in rundown of the herbicide and injury to turf and other plantings downhill. One of the ways to prevent erosion, of course, is to use a mulch. The use of preemergence herbi-

cides under light mulches looks very promising and may be quite valuable in the establishment of ground covers, for example. Weed control often is improved when mulches are used over pre-emergence herbicides. In one experiment in 1-year-old apple whips, growth also was increased up to 75% by using a combination of a hay or plastic mulch and simazine at 3 lbs. per acre.

Mulches also have their place in the sales yard or under container-grown stock. Simazine has been used with good success to control weeds under container-grown stock, although an occasional branch is discolored when a root grows down into simazine treated soil. Placing a light organic mulch over the simazine prevents splash erosion of the herbicide and slows contact between plant roots and the herbicide. Using mulches over pre-emergence herbicides still is in the experimental stage, however, and some caution is advised. Some organic mulches can bind up herbicides and actually decrease effectiveness.

Several questions arise where herbicides are used year in and year out in ornamental plantings. One is obvious—will the soil eventually be sterilized? To answer this we must look at the individual herbicide. Except for simazine, and to a lesser extent trifluralin and neburon, none of the other herbicides widely used in ornamental plantings last for more than a few months in the



**Chickweed control in the spring.** Control results at right of plot could be obtained with neburon, CIPC, Solan, or the wettable-powder form of simazine.

costs; depreciation; correspondence and record keeping; and other administrative expenses.

### Bidrin in DED War

A new weapon which may help arborists wage successful war against dreaded Dutch elm disease is an organic phosphate compound, from Shell Chemical Company, called Bidrin. The new chemical was examined in detail by Dr. Hugh E. Thompson of Kansas State University in Manhattan.

Dr. Thompson said only expertly trained and experienced people are qualified to apply the new chemical, and that the correct dosage for trees is a critical one. Too little may fail to achieve control but too much may harm the tree, the KSU researcher maintained. Bidrin has a residual effect of four weeks, so timing is also crucial. Proper application time is when elms are in flower, Dr. Thompson said.

The material is packaged in specially designed capsules, color coded for different strengths, which can be attached to tree trunks for injection.

Dr. Thompson said the promising new material has received limited label approval and that Shell has printed recommendations for using the product. Use of Bidrin is limited to persons who have become qualified by examination, the Kansan said in conclusion.

### Maple Ills Delineated

A variety of ailments which afflict maples in many areas, referred to variously as decline, blight, dieback, etc., were more specifically described by Dr. George H. Hepting, Principal Research Scientist, U. S. Forest Service, Asheville, N.C. Dr. Hepting said the problems are in fact: (1) New England roadside maple decline; (2) General maple decline in the Northeast; (3) Pathology of the sugar-bush maples; (4) Insect-induced maple blight of northern Wisconsin; and (5) Sapstreak disease of North Carolina and the Lake States.

Factors related to the New England ailment are road salt application, road widening, as-

phalt applications, and snow plow damage, Dr. Hepting said. In Wisconsin, an epidemic of maple webworm was intensified by a simultaneous infestation of leaf roller. Defoliation and its side effects contributed to a general decline.

The sapstreak disease was shown to be concurrent with extended drought conditions. An overlying problem associated with decline of maples and other northern hardwoods is that of general attrition due to a succession of years with below-normal precipitation and above-normal temperature. Accumulated moisture deficits brought about a chain of adverse happenings which cause decline.

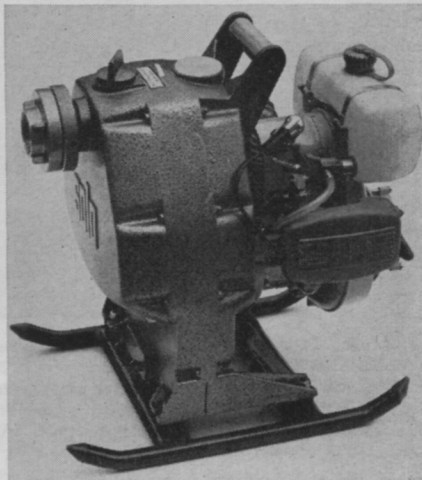
### What the Utilities Want

A lecture of avowed interest to arborists, who traditionally reap much of their present income from utility work, was presented by P. C. O'Shee, Superintendent of Distribution, Alabama Power Company, Birmingham. O'Shee said fair prices, economical tree trimming, good public and customer relations, financial considerations about expensive equipment, and good line clearing supervisors are necessary to fulfill utility work. But he hastened to point out that it is indeed a "two-way street," and that the utility should have a supervisor who's trained in line work so he can work with the contractor; that the utility should realize the contractor must make a profit and pay for expensive equipment; and that personalities of foremen, owners, and utility personnel should be compatible.

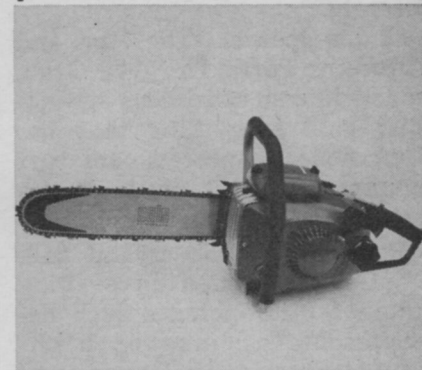
He reminded the arborists that when they're out doing work for the utility, they are in effect working for the utility itself, and must be careful to create good impressions for the power company.

NAA officials told *Weeds Trees and Turf* that dates for next year's meeting will be announced on these pages at a later date. The NAA also meets jointly August 15-20 in Washington, D.C., with the International Shade Tree Conference.

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