

**MANAGEMENT OF UNDESIRABLE PLANTS
IN ORNAMENTAL CONTAINERS
AND GROUND COVERS
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Management of most undesirable plants in the nursery or landscape is possible with herbicides available today. New chemicals are on the horizon for use in ornamentals which will make this costly job easier and cheaper in the future. With the move toward "low maintenance" and "greenbelting" there will be a greater dependence upon chemicals to manage the environment. To get the most from these chemicals their effectiveness must be maximized, and they must be used safely. However, it should not be assumed that chemicals can solve all plant maintenance problems nor replace proper management.

The herbicides discussed here may not be currently labeled and recommended by the manufacturer, thus they should not be construed as recommendations by the University of California. Presently, there are few herbicides that are labeled for use in ornamental containers so I can only report research findings. In ground covers and plants in the landscape, several herbicides are available and have commercial labels. More companies are in the process of requesting labels for their herbicides.

The cost of hand weeding ground covers can be exorbitant on previously used land. Costs would normally be less on cut and fill areas such as highway landscaping. In recent comparisons of weeding costs at Davis and Santa Clara ground cover trials, costs were \$2,941 per acre for an untreated area. Some of the treated areas were DCPA (Dacthal®), \$281; nitratin (Planavin®), \$399; and nitratin (Tok®), \$377. These were treatments applied to newly planted ground cover plants as preemergence treatments.

Most selective herbicides that are presently in use do not control all annual weed species. In some areas tolerant weed species such as bur clover, sow thistle, bittercress, and marestail are becoming real problems. The weed species in an area to be planted should be known in order to select the herbicide or herbicide combinations that will be most apt to provide an acceptable level of weed control. The herbicides presently being used, and those under study reported here, have been divided into preemergence (before weeds emergence) and postemergence (young or established weeds) chemicals.

Preemergence Herbicides; Diphenamid (Dymid[®], Enide[®]) is now used widely in new and established ice plant (*Carpobrotus edulis*) plantings. Diphenamid is very effective on most weed species by itself in the coastal areas of California. In interior valleys of California, a combination of diphenamid and trifluralin (Treflan[®]) has given longer grass control than with diphenamid alone. Nitralin (Planavin[®]) has been used in ground cover plantings and is presently labeled for container ornamentals. Nitralin and trifluralin are principally effective on annual grass species and are less effective on mustard, sow thistle, common groundsel and shepherd's purse.

DCPA (Dacthal[®]) can be used on most ornamental plantings. Although weed control in some of the high organic matter, heavy clay soils, is less than desirable it is very good on lighter soils and is generally safe on ornamentals. DCPA is presently being used in container ornamentals and ground cover plantings.

Norea (Herban[®]) is being used in coastal areas of California in *Hedera canariensis* (Algerian ivy) principally for bur clover control. Other ground cover species and some conifers are severely injured by norea.

These herbicides are applied to ground covers before weeds germinate or after the weeds have been removed by hoeing or pulling. On newly planted ground cover, the plants are planted as rooted cuttings or in the case of *Carpobrotus edulis*, unrooted cuttings. The area is irrigated before herbicide treatment to settle the soil around the plants, thus reducing the amount of herbicide moved with the water down around the plant roots. Approximately three days after planting, the area is treated with herbicide and followed with another irrigation.

In some established plantings of *Carpobrotus edulis*, low rates of simazine (Princep[®]) have been used. If simazine is used in *C. edulis*, it must be applied very carefully to maintain a low rate because there is very little margin of tolerance. Excess applications of this herbicide can severely injure desirable plantings and restrict replanting.

Two possible problems with preemergence herbicide treatment to newly planted ground covers are the possibilities of stunting and/or loss of weed control. If the correct rate is used and the soil is firmly settled around rooted cuttings or the unrooted cuttings are planted deeply enough, there is very little chance of stunting. In the second case, there are two possible explanations—the correct herbicide and rate must be used on susceptible weed species. If tolerant species are present, weeds will not be controlled and must be hand pulled or controlled with a postemergence herbicide.

Several preemergence herbicides have been tested on ground cover species. Listed below are species and herbicides tested and their general tolerance to newly planted ground covers. These data are

compiled from three locations in California, (1) South Coast Field Station, Tustin; (2) San Jose Field Station, Santa Clara; and (3) University of California, Davis. The data are summarized from testing during the years of 1968 through 1971 in either fall or spring applied trials. Some of the uses that are indicated as safe here would be influenced greatly by such factors as soil type, organic matter and irrigation practices before and after application. (Table 1 and Table 2).

As indicated by the safety of the herbicides trifluralin, nitralin and DCPA in ground covers, many nurseries are presently using these chemicals in containers. This subject was covered thoroughly in a presentation given by Humphrey (1) to this Society in 1968.

Postemergence Herbicides: Presently, there is no postemergence herbicide that can be used safely in containers with marked success. Nitrofen (Tok[®]) has been used on very small areas on seedling weeds in the two to three leaf stage. There are many species not yet tested for tolerance.

In ground covers, only a selected few herbicides can be used postemergence to weeds. In *C. edulis*, amino triazole at 1 pound per acre has been used with considerable chlorosis (yellowing) of the plants; they subsequently recover. Ammonium sulfate or magnesium chloride (bittern) has been used extensively at 3 pounds per gallon of water of either chemical. These are applied at 200 gallons of water per acre. A wetting agent or surfactant must be added at one quart per 100 gallons of water. Temperatures must be above 75° F. for satisfactory results.

In *H. canariensis*, dalapon has been used at 4 pounds per acre plus wetting agent for bermudagrass control. Normally several treatments are necessary. Slight injury may result from this treatment.

Vinca minor will tolerate 2, 4-D amine for broadleaf weed control; has been used at 1 pound per acre with only temporary curling of new growth of the *Vinca minor*.

Nitrofen or diphenamid has also been used on very young weeds as a postemergence. Nitrofen at 4 pounds per acre has controlled most weed seedlings in the two to three leaf stage. Weed species tolerant of this treatment are *Stellaria media* (chickweed) and members of the *Cruciferae* family (mustards). Diphenamid has been most effective when applied to control young grasses and irrigated well after application. Growth suppression will result even though in many instances the weeds will not be killed.

Listed below are some of the postemergence herbicides and tolerances indicated for some common ground cover species. Vigor of the plant, stage of growth and temperature will all influence plant tolerance to postemergence herbicides. The list indicates tolerance or lack thereof for various herbicides and rates used in University of

Table 1. Relative Tolerance of Ornamental Plants Used as Ground Covers to Post-Plant, Preemergence Herbicides*

	Triflura- lin (Treflan®) 2lb / A *	Triflura- lin 4lb / A	Nitralin (Planavin®) 2lb / A	Nitralin 4lb / A	DCPA (Dacthal®) 8lb / A	DCPA 16lb / A	Diphena- mid 10lb / A
<i>Aloysia triphylla</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Ajuga reptans</i>	▲	⊕	▲	⊕	▲	●	⊕
<i>Baccharis pilularis</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Carpobrotus edulis</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Cerastium tomentosum</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Delosperma 'Alba'</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Drosanthemum hispidum</i>	⊕	⊕	⊕	⊕	⊕	⊕	▲
<i>Gazania rigens</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Hedera canariensis</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Hedera helix</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Hypericum calycinum</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Malephora luteola</i>	⊕	⊕	⊕	⊕	⊕	⊕	▲
<i>Osteopermum fruticosum</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Pelargonium peltatum</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕
<i>Sedum brevifolium</i>	⊕	⊕	⊕	⊕	⊕	⊕	▲
<i>Sedum rubrotinctum</i>	⊕	⊕	⊕	⊕	⊕	⊕	▲
<i>Verbena tenera</i>	⊕	▲	⊕	⊕	●	●	▲
<i>Vinca minor</i>	⊕	⊕	⊕	⊕	⊕	⊕	⊕

- ⊕ — No injury observed
- ▲ — Injury observed, such as stunting, burning or dieback, normally regrowth occurs
- — Susceptible to injury, to killing of plants
- - Not sufficient data

* lb / A is pounds active ingredient per sprayed acre

Table 2. Relative Tolerance of Ornamental Plants Used as Ground Covers to Post-Plant, Preemergence Herbicides

	Simazine 1 lb / A *	Dichlobenil 4 lb / A	Nitrofen 4 lb / A	Diphen- amid 10 plus Triflura- lin 2	Simazine ¹ plus Triflura- lin 2	Norea (Herban [®]) 4 lb / A
<i>Aloysia triphylla</i>	—	—	⊕	⊕	⊕	—
<i>Ajuga reptans</i>	●	—	⊕	—	●	—
<i>Baccharis pilularis</i>	—	—	⊕	⊕	—	—
<i>Carpobrotus edulis</i>	▲	▲	⊕	⊕	▲	●
<i>Cerastium tomentosum</i>	—	●	⊕	▲	—	—
<i>Delosperma alba</i>	●	●	⊕	⊕	●	●
<i>Drosanthemum hispidum</i>	●	●	⊕	⊕	—	●
<i>Gazania rigens</i>	●	●	⊕	⊕	▲	●
<i>Hedera canariensis</i>	▲	▲	⊕	⊕	▲	▲
<i>Hedera helix</i>	—	—	⊕	▲	—	—
<i>Hypericum calycinum</i>	▲	—	▲	—	▲	—
<i>Malephora luteola</i>	●	●	⊕	⊕	●	●
<i>Osteospermum fruticosum</i>	—	▲	⊕	⊕	▲	●
<i>Pelargonium peltatum</i>	—	⊕	⊕	⊕	—	—
<i>Sedum brevifolium</i>	⊕	▲	⊕	▲	⊕	●
<i>Sedum rubrotinctum</i>	—	▲	—	▲	—	—
<i>Verbena tenera</i>	●	●	—	▲	—	—
<i>Vinca minor</i>	▲	▲	⊕	▲	⊕	●

⊕ — No injury observed

▲ — Injury observed, such as stunting, burning or dieback, normally regrowth occurs

● — Susceptible to injury; to killing of plants

— — Not sufficient data

* lb / A is pounds active ingredient per sprayed acre

Table 3. Relative Tolerance of Ornamental Plants Used as Ground Covers to Postemergence Herbicides

	Amino Triazole *	Dalapon 4 lb / A	22,4-D 1/2 lb / A	2,4-D 1 lb / A	Magne- sium Chloride	Ammo- nium Sulfate	Bromoxy- nil	1 lb / A MCP	1 lb / A MCP	2 lb / A MCP	MMA 4 lb / A
<i>Aloysia triphylla</i>		⊕		●							⊕
<i>Ajuga reptans</i>	●		▼	●						▼	
<i>Baccharis pilularis</i>					⊕						
<i>Carpobrotus edulis</i>	▼	▼	▼	●		⊕	●	●	●	●	▼
<i>Cerastium tomentosum</i>											
<i>Delasperma alba</i>	●		●	●			●	●	●	●	
<i>Drosera rotundifolia</i>											
<i>Gazania rigens</i>	●		▼				⊕		⊕	▼	
<i>Hedera canariensis</i>	▼		▼				▼	⊕	⊕	⊕	
<i>Hedera helix</i>	▼		⊕				▼	⊕	⊕	⊕	
<i>Hypericum calycinum</i>	▼		▼	▼			▼	⊕	⊕	▼	
<i>Malephota luteola</i>											
<i>Osteospermum fruticosum</i>											
<i>Pelargonium peltatum</i>											
<i>Sedum brevifolium</i>	▼		▼				▼	⊕	⊕	▼	
<i>Sedum rubrotinctum</i>											
<i>Verbena tenera</i>											
<i>Vinca minor</i>	▼		⊕				▼			⊕	

⊕ — No injury observed

▲ — Injury or symptoms observed, severe chlorosis or twisting; normally regrowth occurs

● — susceptible to injury, to killing of plants

— — Not sufficient data

* lb / A is pounds active ingredient per sprayed acre

California testing. These may not always represent label rates and in some instances no label is available for the herbicide listed. (Table 3).

Further research is being conducted in ground covers, ornamental plantings in containers and in the field. Recommendations will be slow in coming because of the wide variety of plants involved and various planting and growing conditions. However, it is hoped that the information contained herein will spur individual experimentation to establish guidelines for proper use of herbicides in ground covers and woody ornamentals.

LITERATURE CITED

1. Humphrey, W.A., 1968. What's new in herbicide use in container-grown plants? *Proc. Inter. Plant Prop. Soc.* 18:199-201.

MODERATOR BROWN: Thank you, Clyde. Now are there questions?

GENE BACIU: In your ground cover tests did you plant weed seeds or did they just blow in naturally?

CLYDE ELMORE: We didn't plant weed seeds there; however we did plant a row of blue grass, rye, fescue grass mix as an indicator grass and we planted dichondria, which often is a good seedling weed. But we did have an excellent natural stand of weeds as well.

GENE BACIU: I was thinking, in my yard, weeds like to collect in certain areas for some reason.

CLYDE ELMORE: Yes. Now, normally we do not seed weeds into the herbicide trials, however, we do seed indicator plants—an annual plant—to get some indication on those. But in most areas we've been fortunate, or unfortunate, enough to have natural weed population.

VOICE: How long after Treflan is applied as a herbicide should you irrigate?

CLYDE ELMORE: Treflan should not be applied to wet soil. It should be applied only to dry soil for greatest activity and if you can incorporate, with a mechanical incorporator, to mix it in the soil, you'll get the greatest activity. You can also reduce the rate that you will use from what I've indicated here. In agricultural soils you normally can get by with $\frac{3}{4}$ to one pound per acre whereas if you sprinkle it in you almost double everything that you incorporate in. As far as time, it should be within 3 to 4 hours if it's on moist soil or humid days. But I would say definitely in most of California, anyway, we would like

to see it incorporated within 24 hours. I would not want to see it go longer than that, even on dry soil.

BRUCE USREY: Do you have any recommendations for spotted spurge control in juniper?

CLYDE ELMORE: No, I don't. You can use the preemergence herbicides. Dacthal is much better as a preemergent than any of the other common herbicides for spotted spurge control. There is no easy answer for spurge control in any of our junipers. But preemergence Dacthal has looked better than anything else. If you have heavy soils, you could even use simazine, but you'd have to be extremely careful with it.

BRUCE BRIGGS: At what time of year and at what temperature should TOK be applied—what sort of weather conditions?

CLYDE ELMORE: We've applied TOK mostly under cool conditions—cool weather when the temperature has been below 75° F. There doesn't seem to be as much difference in temperature as there is on how well the weeds are growing and the stage of growth. If you get them at the two to three leaf stage, and the weeds are growing rapidly, temperature does not make that much difference. If you use it at higher temperatures, you're going to increase the injury to the ornamental plant.

MODERATOR BROWN: Clyde, we appreciate your taking time to share this up-to-date knowledge with us. We are looking forward to the Proceedings coming out so we can use the information you have presented here today. Thank you.

Our next speaker will be talking on disease-free propagation in relation to standardization of nursery stock. He is a gentleman who has contributed a great deal to the nursery industry and to all plant propagators; he is known to all of you. Dr. Kenneth F. Baker, of the Department of Plant Pathology, University of California, Berkeley.

**DISEASE-FREE PROPAGATION IN RELATION TO
STANDARDIZATION OF NURSERY STOCK
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It is a truism that there are two sources of plant disease organisms — the soil (including organic matter and water) and the host plant. Thus disease control in the nursery comes down to (a) the use of treated or pathogen-free soil, (b) use of pathogen-free