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WEED CONTROL ADJACENT TO GRASSED AREAS

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Turfgrass managers are nearly always responsible for maintenance of flower beds, plantings of trees and shrubs, paths, or small drainage channels, in addition to actual areas of lawns. Control of weeds in such areas, in gravel and flagstone walks, in parking areas and patios adjacent to turf is a serious problem. Machine methods are not adaptable to most situations and chemical methods are often hazardous to adjacent turfgrass and ornamentals. The roots of trees and shrubs are often present, limiting the use of soil-acting chemicals and foliage sprays that eave toxic soil residues.

There are a large number of chemical weed killers commercially available. Some are general weed killers while others control only certain weeds. Some may be used safely in the presence of other plants in specific instances, but the resistance of most ornamental species to the newer herbicides is not known.

Soil Sterilants

When properly applied soil sterilants are not hazardous to nearby turfgrass. Leaching carries the chemicals predominantly downward with very little lateral movement. The principal hazard is to trees and shrubs having roots extending into treated areas. Where distance from trees is considerable -- 30 to 50 feet or more – it is advantageous and relatively safe to use permanent soil sterilants. Single treatments of the urea herbicides (CMU or DCMU), chlorates, borates, arsenicals, or combinations of these materials control all vegetation for several seasons and may be renewed periodically **at** relatively low cost. These chemicals are leached into the soil by rainfall or irrigation. They are toxic to all plants and will be picked up by roots and transported to trees and shrubs where systemic injury may result. For long-term sterilization CMU may be used at rates of 20 to 40 pounds per acre, borax or chlorate-borate mixtures at two to four pounds per 100 square feet, and borascu at four to eight pounds per 100 square feet. These chemicals are applied dry or may be dissolved and sprinkled or sprayed on the soil surface. Treated areas should be sprinkler-irrigated (avoiding runoff) to take the chemical into the soil.

Fumigants

Fumigants may often be used to advantage to control perennial weeds near turf plantings. Control by fumigation is only temporary, however, as no toxic materials remain in the soil and recontamination can occur immediately. Fumigation kills the roots of trees and shrubs in treated areas, but this is a "pruning" action, killing the roots contacted. There will be no systemic injury due to absorption of chemicals. If large areas of the root zone are treated, resulting in root killing, the plants may suffer from lack of ability to absorb sufficient water.

Methyl bromide at one pound per 100 square feet applied under well-sealed tarps and held for 24 hours controls such weeds as nutgrass and bermudagrass, and in addition kills most weed seeds, Methyl bromide is very poisonous and must be handled with caution. Injections of two ounces of carbon bisulfide in holes six inches deep and twelve inches apart control deep-rooted perennials such as wild morning glory. The vapors of carbon bisulfide are highly explosive. Ethylene dibromide and DD control nutgrass, oxalis, and other tuberous or bulbous species when injected at the rate of one-half ounce per hole with twelve-inch spacings and four to six inches deep.

Vapam -- a new liquid fumigant -- may be used to control bermudagrass and other perennials. The material is used at the rate of one quart per 100 square feet. To fumigate an area Vapam is mixed with water and sprinkled or sprayed on the soil surface then leached in by sprinkler irrigation. Depth of fumigation may be controlled by the amount of water used before application and to carry the chemical into the soil. To kill the roots and rhizomes of deep-rooted weeds deep leaching is needed. For control of shallow species such as bermudagrass less water is required. Excellent control of shallow-rooted perennials above tree or shrub roots has been obtained by first thoroughly soaking the soil and then while it is fully wet, applying the Vapam. Leach it immediately into the soil by sprinkler irrigation. Apply only enough to carry the material two to four inches deep, normally about 1/4 inch of water.

Results with Vapam are most reliable when the chemical is uniformly diluted in the irrigation water and soaked to the desired depth. One way to do this is to meter the Vapam into the water of a sprinkler system

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Weed Control Adjacent To Grassed Areas

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during irrigation. A liquid proportioner attached to a garden hose may be used for application to small areas. Diluting the concentrate with one or two equal volumes of water is an aid in getting uniform distribution when using a sprinkler can. Some very shallow rooted tips of bermuda may survive. They can be easily eliminated with spot treatments of oil.

Nutgrass is relatively resistant to Vapam. Doses of two to three, quarts per 100 square feet must be applied and leached uniformly to a depth of 18 inches.

Contact Sprays

General contact weed killers, that is materials that kill only the parts of plants actually wet by the spray, are particularly useful in ornamental plantings. Contact sprays give a complete kill of annual plants, but perennials usually regrow from underground roots or stems.

Stoddard solvent is a light oil useful as a general contact spray in landscape plantings. It is well known to agriculture as "carrot oil" and is available on the market as Shell 10, Arland 76, Richfield #1, and many other names. It is preferred to the usual grades of weed oil because it does not stain flagstones and other masonry work. Small quantities of this type of oil may be purchased from service stations and hardware stores as cleaning solvent or paint thinner. For best results stoddard solvent and other oils should be applied when weeds are less than two inches tall. Annual bluegrass becomes resistant, for example, soon after it emerges as a seedling and forms a "crown". Weeds of the carrot family are not killed by stoddard solvent, but they are rarely a problem in landscaped areas.

The solvent may be applied from a compressed-air knapsack sprayer operating at 30 to 40 pounds pressure. Use very fine "fan" type nozzles with capacities of 1/2 to 1 gallon per hour. For precise applications the spray may be accurately controlled by holding the nozzle close to the weed growth. This permits accurate spraying between bricks, along the edges of sidewalks, and close to the stems of shrubs and flowers. Avoid actually wetting the stems of ornamentals with the oil. A 6-inch funnel over the nozzle enables a skillful operator to spray under foliage.

In areas where staining of masonry is not a problem or where a little yellow stain is not objectionable, commercial grade, high-aromatic weed oils are preferable. They are better weed killers for general spraying of weeds in all stages of growth. These "hotter" oils are on the market as Richfield' A, Shell 20, Avon Annalos 7 or 11, Standard's 55 -AR and others. Some lots of diesel fuel are good weed killers, others are not. Diesel oil can be "fortified" with a pint of Dow General of Sinox General to 100 gallons, thus making it an excellent killer.

Ammate (ammonium sulfamate) is an excellent weed killer for driveways and walks. Annual weeds *are* killed, and top kill as well as some root kill of perennials is obtained from thorough wetting with a solution containing 3/4 pound of ammate and 1/3 teaspoonful of liquid laundry detergent per gallon of water. Ammate is corrosive to metal. The sprayer should be thoroughly washed after use. In the quantities used, weed oils and ammate do not leave soil residues that are toxic to underlying roots or subsequent plant- growth.

Regardless of the particular material used, spraying should be on a program basis so that successive crops of weeds will be killed before they go to seed. This gradually depletes the population of weed seed in the surface soil until only occasional weeds reappear after a spraying. Deep cultivation should be avoided for it will bring a new lot of weed seeds to their favorite germinating depth. If they remain deeply buried they will not grow.

Other Promising Weed Killers

Of the many weed killers available for specific uses the following have possible value in the management o landscaped areas.

SES (Crag herbicide No. 1) is a non-toxic formulation which after addition to the soil decomposes to release a material toxic to germinating seeds. Mature plants of most species are not affected. The activity of SES gradually disappears after several weeks.

Alanap is a temporary soil sterilant which is likewise applied to the bare soil prior to germination. Weeds are killed as they germinate. Mature plants are relatively resistant.

Dalapon is a new chemical of particular value in controlling weedy grasses. It controls bermudagrass and other perennial grasses at rates of 20 to 40 pounds per acre and annual grasses at rates below ten pounds per acre. Dalapon is absorbed by the foliage and translocated throughout the plant, killing roots and rhizomes as well as tops. After a treatment dalapon residues may become leached into the soil in sufficient quantity to be toxic to the roots of trees and shrubs. Therefore, it should not be used over roots.

Amino triazole is a new weed killer that is effective on both grasses and broad-leaved weeds. It is absorbed by the foliage and translocated to underground plant parts. Preliminary experiments indicate that it can be safely used on weeds growing within the root zone of trees and shrubs.

Neburon is a new soil sterilant similar to CMU which because of its very low solubility does not leach readily to roots underlying treated areas. When applied prior to seed germination, seedlings are killed at the time of emergence. Tests with neburon indicate that it may be safely used in the root areas of trees and shrubs. Neburon is a herbicide of exceptional promise for a number of uses in landscape management.

WEEDFREE TURFGRASS SEEDBEDS

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One of the ways to approach the problem of obtaining a weedfree new turf is to destroy weeds and weed seeds in the seedbed prior to planting. In the past the only method which could be used was to cultivate the area several times before seeding, allowing a new crop of weeds to germinate between cultivations. This is a laborious method which is only partially successful. Today several chemicals can be used to destroy most weeds and weed seeds quickly and easily. These materials have been tested at the UCLA turf plots during the past year.

Methyl bromide has been used for a number of years as a soil fumigant for the control of nematodes and soilborne pathogens in greenhouse and similar operations. Now it is also being used to an ever-increasing extent as a herbicide in turf seedbed preparation. Methyl bromide is colorless and odorless poisonous gas. It is sold in cans or cylinders as a liquid under pressure which volatilizes upon release from the container. Most weeds, including bermudagrass, weed seeds, soil inhabiting fungi, and nematodes are controlled with one application.

Since methyl bromide is a gas it is necessary to cover the area being treated with a gas-proof plastic tent sealed at the edges and held 5 to 8 inches off the ground by a support such as burlap bags stuffed lightly with straw. The gas is released from the cans through plastic tubes running under the cover. The end. of the tube must be placed in an evaporating pan to allow uniform dispersion of the gas throughout the covered area. One pound of methyl bromide will treat 100 sq. ft. of most soils.

The cover may be removed after 48 hours and the new turf planted 2 to 4 days later. Methyl bromide is toxic to all plant life and should not be used near trees or shrubs.

Because methyl bromide is extremely poisonous, it is not recommended for home use. All precautions suggested in the manufacturer's directions should be carefully followed.

Vapam is the trade name for a new liquid material for seed bed preparation. The active ingredient in Vapam is sodium n-methyl dithiocarbamate dihydrate. It decomposes rapidly in the soil to form a gas. Most weeds, weed seeds, fungi, and nematodes are also controlled by this material.

Vapam is easy and relatively safe to use in comparison to methyl bromide. Application can be made with a sprinkling can or hose proportioner at the rate of 1 to 11/2 quarts to 100 sq. ft. The area to be treated should be moist before the application and must be watered immediately after treatment to wash the material into the soil and to form a water seal which holds the gas in the soil. Watering must be done carefully to prevent washing the Vapam to adjacent plants which are not *to* be killed. It is not necessary to cover the treated area.

Some seeds or bermudagrass stolons lying on the soil surface may escape treatment. This can be at least partially overcome by cultivating the soil prior to treatment to bring such plant material into the soil fumigation zone.

Studies at UCLA show that an application of a weed-oil spray 2 to 4 days after the Vapam treatment will destroy any surviving bermuda stolons. Calcium cyanamid at 2% lbs. to 100 sq. ft. will also destroy the bermuda stolons and many of the surface weed seeds.

Vapam treated areas have been successfully seeded 7 to 10 days after treatment at UCLA, but it is generally advisable to wait at least 2 weeks before replanting. If calcium cyanamid is used in combination with Vapam at least 2 to 3 weeks should be allowed between treatment and replanting.

As with methyl bromide, Vapam should not be used near shrubs and flowers or under trees.

Calcium cyanamid is a granular material which serves both as a herbicide and as an excellent nitrogen fertilizer. It is the safest material for home use. While it may not be as effective as the two aforementioned materials, it is the only material which can be used near shrubs and under trees. All annual and many perennial weeds are killed, as well as most weed seeds. It is not an effective herbicide for bermudagrass and similar weeds with deep rhizomes.

Calcium cyanamid may be applied at the rate of 5 lbs. to 100 sq. ft. in either of two ways. The entire amount may be applied at one time, worked into the top 1 to 2 inches of soil and watered thoroughly. Another method is to spread one-half of the material and work it into the soil, then spread the other half on the surface and water thoroughly. The soil must be kept moist for a period of about 3 to 4 weeks before replanting. In addition to its herbicidal action, this material will supply enough nitrogen to last for several months. Phosphorus and potash should be applied as needed since these nutrients are not supplied by calcium cyanamid.

Often the primary weed problem is the eradication of bermuda and other grasses. Dalapon is an excellent new grass killer which will completely kill solid stands of bermuda, kikuyu and dallis grass. Only at high rates of application will it be effective on most broad-leaved weeds. Dalapon should be applied at the rate of 2 to 5 ounces to 1000 sq. ft. It should be dissolved in enough water to thoroughly and uniformly wet all the foliage in the area to be treated. Application is best with a sprayer, but a sprinkling can may be used. The grasses should be growing well at the time of application for best results. There should be no attempt to replant for at least 30 days after treatment.

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CONTROL OF CRABGRASS WITH CHEMICALS

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Chemical control of crabgrass has been the subject of many investigations in recent years. As a result of this numerous preparations are now available for the control of crabgrass infestations in established turf.

Tests of several crabgrass herbicides were conducted on the 15th Fairway of the Bel-Air Country Club of Los Angeles during the summer of 1956. The area used for the tests had been heavily and uniformly infested with hairy crabgrass, Digitaria sanguinalis, in 1955. The turf in the area consisted of a mixture of bermuda, bluegrass, bents, and fescues. Both pre-emergence and post-emergence materials were used in this test. Seven chemicals, applied at various rates and schedules, and a check plot made a total of 14 treatments as shown in the table. The chemicals used were:

1. Pax AR-76, 8.25% standard lead arsenate, 25.11% arsenous oxide, 0.35% technical chlorodane
2. Alanap l-F, 1% N-l naphthyl phthalamic acid
3. Crag Herbicide 1 - 90% 2,4-dichlorophenoxyethyl sulfate
4. PMAS - 10% phenyl mercuric acetate
5. Standard lead arsenate with Milorganite
6. 18.90% disodium methyl arsonate anhydrous
7. Experimental herbicide 140 - 20% Sodium Arsonoacetate.

All treatments were randomized in 4 replications. Each plot was 100 square feet in size.

The first application of pre-emergency materials was made on March 1, 1956, before crabgrass had begun to to germinate. Crabgrass seedlings in the two-leaf stage were first observed March 22, 1956. The first post-emergence herbicides were applied at this time.

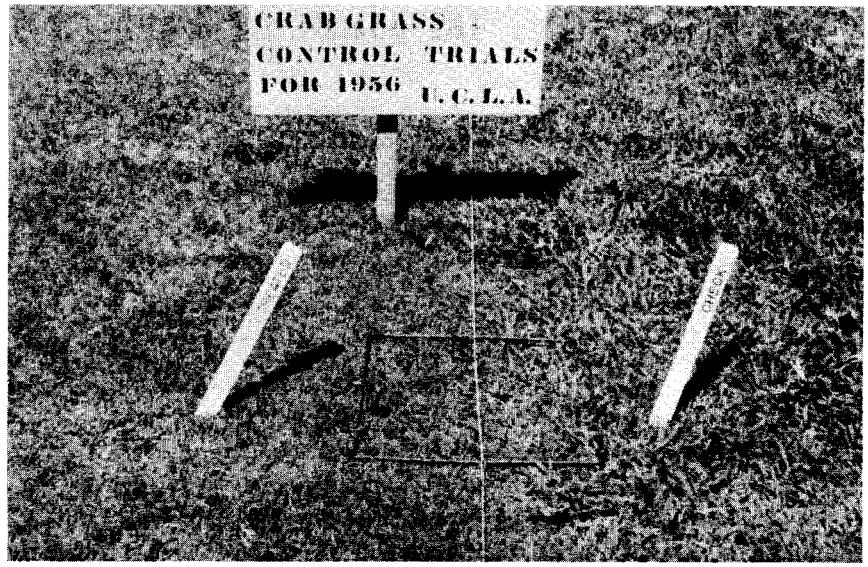
Phenyl mercuric acetate applications were begun when the seedlings were small as observations have shown this to be the most effective period for the use of this material. Disodium methyl arsonate and Experimental herbicide 140 were first applied at the time of peak crabgrass germination. Turf injury and discoloration notes were taken one week after treatments. Estimates of the number of crabgrass plants surviving each treatment were made by counting the number of plants found in four one-square-foot plots taken at random in each treatment. These counts were made twice during the summer, June 18, and September 13.

The results of this experiment are presented in the table below:

CRABGRASS CONTROL IN TURF WITH VARIOUS CHEMICAL TREATMENTS

TREATMENTS RANKED ACCORDING TO EFFECTIVENESS- JUNE 1956 READINGS	APPLICATION DATES	APPLICATION RATE PER 100 Sq. FT.	NUMBER OF CRABGRASS PLANTS PER SQ. FT. AVERAGE OF 4 REPLICATIONS		REMARKS
			JUNE 18, 1956	SEPT. 13, 1956	
1. Pax AR-76. Pre-emergence 1 application	March 1	3.33 lbs.	0.06	0.00	Slight turf injury noted l week after treatment. Followed by improved color
2. Pox AR-76 Pre-emergence 1 application	March 1	2.5 lbs.	0.06	0.00	Same as above
3. Disodium methyl arsonat Post-emergence 2 applications	May 14, 23	0.67 oz. in 1 gal. water	0.56	11.25	No turf injury or discoloration
4. Alanap 1-F. Pre-emergence 3 applications	March 1 April 1 May 15	1.8 lbs.	1.06	1.56	No turf injury. improved color 1 week after treatment
5. PMAS. Post-emergence 3 applications	March 22, 29 April 15	0.25 oz. in 1 gal. water	1.19	10.81	No turf injury or discoloration
6. Alanap 1-F. Pre-emergence 4 applications	March 1, 29 May 14 June 22	1.8 lbs.	1.56	2.50	No turf injury. Improved color 1 week after treatment
7. Alanap 1-F. Pre-emergence 3 applications	March 22 May 14 June 22	1.8 lbs.	1.56	22.31	Same as above

IMPROVED TURF QUALITY RESULTING FROM CHEMICALTREATMENT TO DESTROY CRABGRASS ->



The crabgrass population estimates as presented in this table show that a number of chemicals are now available which will greatly reduce crabgrass infestations with little or no injury to the desirable turfgrasses. The great turf improvement which was obtained is shown in the accompanying photograph.

Several additional observations should be mentioned. All pre-emergence materials must be applied before any crabgrass seed germinates for best results. In southern California this should be no later than early March. Several applications of post-emergence herbicides must be made to obtain good kill of crabgrass. A second series of post-emergence herbicide treatments should be made in late summer to kill new crabgrass plants from late germinating seed. Improved turfgrass color and growth was obtained from the Pax and Alanap 1-F in addition to an excellent control of crabgrass.

In addition to this series of tests a small test of Du-Pont Crabgrass and Chickweed Preventer (Neburon) was made in an adjacent area. This material arrived too late to be included in the regular test. Unfortunately, by this time crabgrass seed had begun germination. Nevertheless population counts showed this material to be an effective herbicide for crabgrass. It was applied in a single application at the rate of 0.8 oz. for 100 square feet of turf.

8. Crag Herbicide 1. Preemergence 4 applications	March 1, 29 May 14 May 23	0.30 oz. in 1 gal. water	2.31	11.06	No turf injury or discoloration
9. Standard lead arsenate t Milorganite. Pre-emergence - 1 application	March 1	11 oz. lead arsenate t 4 lb lbs.Milorganite	4.50	17.13	No turf injury or discoloration. Improved color
10. Disodium methyl arsonate Post-emergence 3 applications	May 14, 23 June 22	0.67 oz. in 1 gal. water	5.44	20.50	No turf injury
II. Crag Herbicide 1. Pre-emergence 4 applications	March 29 May 14, 23 June 22	0.30 oz. in 1 gal. water	11.00	32.81	Same as above
2. Experimental Herbicide 1. Post-emergence 5 applications	May 14, 23 June 1, 7, 22	0.5 oz. in 1 gal. water	12.25	45.31	Same as above
3. Disodium methyl arsonate Post-emergence 1 application	May 14	0.67 oz. in 1 gal. water	12.31	65.44	Same as above
4. Check. No treatment			23.88	95.94	
L.S.D. at Probability of 5%			3.86	32.90	

A difference between treatments greater than 3.86 for the June counts and 32.90 for the September counts is significant at 5% Probability level.

THE USE OF 2,4-D AND 2,4,5-T IN TURF

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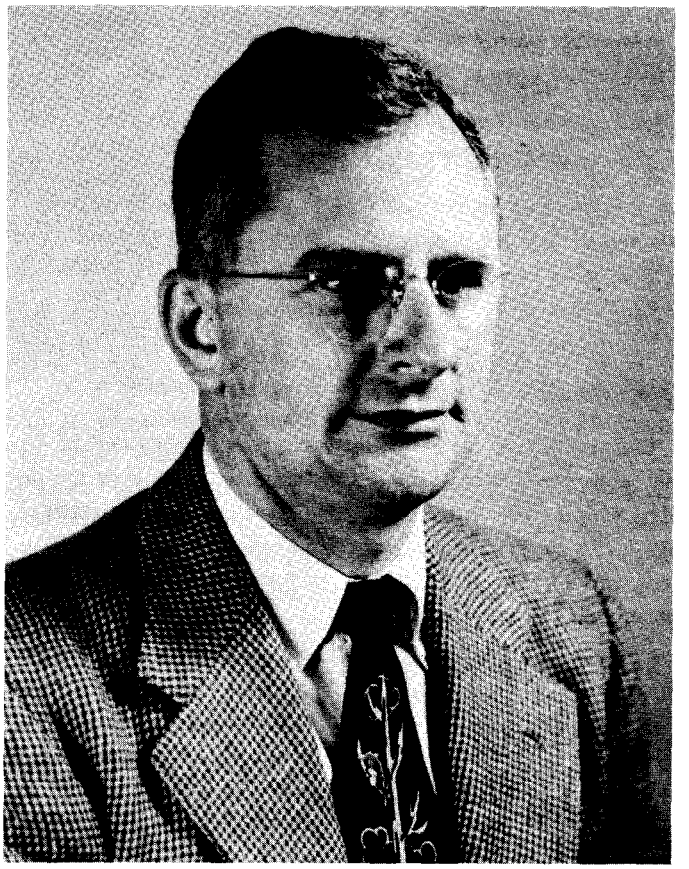
Chemical weed control has become an accepted practice in the management of turf areas in California. Many different chemicals are used and the list of them grows longer every year. Probably the most widely used chemicals are 2,4-D and the related 2,4,5-T. These control a variety of broad-leaved weeds and have been in use for about 10 years. Nevertheless, mistakes are still being made in the use of these chemicals with the result that turf grasses are sometimes damaged and the weed species not satisfactorily controlled. Let us look again at our use of them to see if we can improve the results and satisfaction obtained from such treatment.

SELECTIVITY - Although we say that 2,4-D and 2,4,5-T are selective herbicides we must realize that selectivity is not absolute. It depends not only on the chemical but also on our use of the chemical--rate, timing of application, volume, turf species, weed species and management both before and after treatment. In general these two chemicals affect broad-leaved plants to a greater degree than they do grass species. But some broad-leaved plants are resistant to one or both of them, and some grasses are susceptible. Thus we must use care in our choice of chemical and our use of it if we are to eliminate the weeds and retain a healthy stand of the grass. Not all weeds, not even all broad-leaved weeds, can be eliminated with these herbicides but many of our most common turf weeds are susceptible and with proper treatment can be controlled.

SUSCEPTIBILITY OF WEEDS - Annual weeds are more readily killed than perennial species and the latter may require several retreatments. Wherever possible 2,4-D is used rather than 2,4,5-T because it will affect a wide range of common weeds and is considerably cheaper, Dandelion, plantain, morning glory, dichondra and pennywort are usually readily killed with 2,4-D although repeat treatments may be necessary. Common chickweed, mouse-ear chickweed, filaree and clover are affected by 2,4-D but may recover. Treatment with 2,4,5-T is more effective on these species. Oxalis, a common lawn pest is much more susceptible to 2,4,5-T.

SUSCEPTIBILITY OF TURF SPECIES - Grasses vary in their susceptibility to damage from 2,4-D. Established bentgrasses and red top turf are easily damaged by 2,4-D. It therefore may be necessary to reduce the strength of the spray solution to about one half that recommended on the label for lawn. Bluegrass and rye grass are relatively resistant. Bermudagrass is highly resistant. The more susceptible grasses should not be treated when young, nor with a heavy dose of chemicals. Clover may be damaged by 2,4-D, but usually not killed. If more clover is desired in the lawn it can be reseeded in the bare spots. With adequate irrigation, the old plants usually recover or new plants come from the freshly planted seed.



MR. W. A. HARVEY

APPLICATION - 2,4-D and 2,4,5-T are obtained from most garden supply stores and agricultural chemical dealers. Each is mixed with water and applied as a spray. A small knapsack or garden sprayer is suitable for the home lawn. A power sprayer is more efficient for large areas, such as parks or golf courses. High pressures are not necessary when applying these chemicals. A pressure of 20 to 50 pounds per square inch is ample. Uniform distribution and the actual amount of 2,4-D or 2,4,5-T applied to the turf are more important than the total volume applied. With a garden sprayer, 4 or 5 gallons per 1,000 feet of lawn can easily be applied, although less will be effective. When a power spray is used on large areas, the usual application is 1 to 1 1/2 pounds of chemical per acre. The amount of active ingredient contained in commercial formulas varies, so directions on the package should be followed.

Mowing of the sprayed lawn should be delayed several days or a week, if possible, after spraying. Sprinkling should be held off for at least 12 hours after the spray is applied.

TIMING - One of the important factors in the successful use of 2,4-D or 2,4,5-T is in the timing of the spray.

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THE USE OF 2,4-D AND 2,4,5-T IN TURF

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Annual weeds are more effectively treated when young and actively growing. Perennial weeds,, such as dandelions, are more easily killed when in good leaf growth. Actually, it is well to wait until the first dandelion flowers are showing in the spring. Old, mature weeds often show little response to 2,4-D, and weeds growing in deep shade are likewise more difficult to control.

FORMULATIONS - Both 2,4-D and 2,4,5-T may be obtained in water soluble amine formulations and in the more oil-like emulsifiable ester formulations. Ordinarily the amine is used where the maximum of selectivity is desired. The Ester formulations can be used, particularly for the harder to kill weeds but the rates mentioned under application should be reduced to approximately half.

Dry formulations of both 2,4-D and 2,4,5-T that may be applied by fertilizer spreader or sprinkled on by hand are also available and effective. For the home owner without a sprayer they permit convenient application as spot treatments or overall coverage. The area should be wet with dew or sprinkled immediately before treatment so the material will stick to the damp foliage of the broad-leaved weeds.

MANAGEMENT - Chemicals alone will not solve all the weed problems in a turf. Reinfestation of sprayed areas occurs unless the grass is encouraged. A thin, starved stand of grass invites invasion. Bare areas will be taken over by weeds unless the grass is encouraged through reseeding, fertilizing, and proper irrigation. New weed seeds are constantly carried into lawn areas. In fact, the soil of most lawn areas has a high population of viable weed seed. Proper management of lawn and turf areas to help keep weeds eontrolled cannot be overemphasized.

PRECAUTIONS - These chemicals are highly effective plant killers and must be used carefully to avoid undesirable effects.

1. Do not spray a newly seeded lawn with 2,4-D.

2. Use a reduced rate of application in spraying bentgrass and red top. These grasses are more easily damaged by 2,4-D and 2,4,5-T than are bluegrass, ryegrass, or bermudagrass.

3. Do not allow the spray to reach other ornamental or crop plants. Even small amounts of drift may injure these plants, some of which are highly sensitive.

4. Keep one sprayer exclusively for 2,4-D. Do not use it for insecticides or fungicides. If the sprayer must be used for other purposes it should be thoroughly washed with several changes of warm water and baking soda or sal soda. Rinse thoroughly several times. Rubber spray hose is particularly difficult to clean satisfactorily. Even small amounts of 2,4-D remaining in a sprayer may be enough to distort and damage sensitive plants treated with insecticides or fungicides from the sprayer.

5. Because these materials can cause damage to many desirable plants and as a protection to both the user and his neighbors, a permit from the local County Agricultural Commissioner is required for their use in quantity..

However, no permit is required for use of a liquid formulation up to one pint per day, or for use of a dry or granular formulation containing less than ten percent actual 2,4-D or 2,4,5-T up to 25 pounds per day. Thus most home owners need no permit but large scale use as on golf courses or parks would be subject to permit.

WEED CONTROL BY TURFGRASS MANAGEMENT

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The problem of maintenance of a weed free turf can be approached in two ways: (1) proper cultural methods or management (2) destruction of weeds by chemicals. The seemingly miraculous accomplishments of chemical weed control in recent years has received such great publicity that the importance of good management in the solution of this problem is often overlooked. The use of herbicides in the end will be of little value if the stand of grass is thin and growing poorly. A thin turf with open spots will be quickly invaded by a new crop of weeds even if all the existing weeds have been killed.

A well prepared seedbed of proper grade, with good subsoil drainage, and with good soil structure should be the starting point if possible. Often this ideal beginning cannot be fully obtained except at a prohibitive cost. If this is the case, strict observance of the other factors in good management becomes of maximum importance. A complete fertilizer should be worked into the soil prior to seeding. Phosphorus, which does not move through the soil readily, can at this time be placed where it will be available to the young grass seedlings as they develop.

The selection of the right seed or planting material should be given careful thought. Only varieties or mixtures of varieties adapted to the region should be used. Quick growing temporary strains, with rare exceptions, should not be used. Temporary or unadapted varieties will make the turf thin and open in a short time, per-

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WEED CONTROL BY TURFGRASS MANAGEMENT

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mitting weeds to become established. Cheap seed or planting material is a poor investment. It is generally inadvisable to buy from firms making sensational claims for any new miracle or wonder grass which will solve all turf problems. There is no such thing, and the purchaser will only be disappointed.

Once a healthy vigorous turf is established the problem becomes one of keeping it so. A fertilization program designed to maintain an adequate level of fertility is essential. An application of a complete fertilizer once or twice a year with supplemental applications of nitrogen every one to two months is an acceptable general program. Six to twelve pounds of nitrogen should be supplied during the year. When the turf begins to lose its dark green color it shows the need of more nitrogen.

Water should be applied so as to encourage the development of a deep root system. This means watering deeply and infrequently. On most soils 1 to 2 inches of water should be applied at each irrigation. The turf should not be watered again until the blades of the grass in open sun wilt or roll. Frequent light waterings which wet only the surface of the soil is a practice which can only weaken the grass and encourages the growth of such shallow rooted weeds as crabgrass.

Mowing height and mowing frequency are important factors in good turfgrass management. Kentucky bluegrass and the fescues should be cut at 11/2 inches or higher. Merion bluegrass can be cut at 1 inch. Grasses which creep on the surface, such as bentgrass and bermudagrass, should be cut at 1/2 inch or lower. It is in the grass blades that the carbohydrates necessary for survival and continued growth of the plant are manufactured. If too much of this tissue is removed the plant will be seriously weakened. The frequency of cutting is as important as the height. If large amounts of foliage are removed at one time the drain on food reserves required to rebuild this tissue will weaken the plant. Cutting should therefore be frequent enough so that only a small amount of foliage is removed in any single cutting. Raising the cutting height during the crabgrass season will shade this sun-loving weed and reduce its ability to compete with the turfgrass.

Compacted soil discourages the development of deep root systems. If water runs off or stands on the surface, it may indicate that the soil is hard packed. As soils become compacted the oxygen supply is reduced, water penetration is restricted, and fertilizers are prevented from reaching the grass roots. The result of this will be a turf of shallow rooted grass which will be vulnerable to attack by disease and easily injured by hot dry periods.

The damaging effects of soil compaction can be reduced by the regular use of an aerification tool which perforates the compacted surface soil layer. Heavy growth of roots can often be seen in these holes soon after aerification. Aerification just before each fertilization is often a good practice on turf that is subject to heavy use.

When diseases or insects attack, proper fungicides or insecticides should be used before the damage is great' enough to leave bare or thin spots for weeds to invade. However, if the turfgrass is kept in a healthy vigorous condition through good management, diseases are much less likely to be a serious problem.

Some weeds will still appear in the turf even when these management practices are observed. It is then time to use chemical control.

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WEEDFREE TURFGRASS SEEDBEDS (cont. from poge)

Dalapon has been used near many trees or shrubs without injury, but since species and varieties may differ in their tolerance to the chemical it is best to keep a safe distance from any plants which are not to be killed. Do not allow spray drift to contact these plants.

No attempt is made in this discussion to give complete directions for the use of these materials. The user should carefully follow all directions and precautions given for their use on the label. All of these chemicals should be kept out of the reach of children, and children should not be allowed to play on treated areas for at least 7 days.

In order that **the information in our publications may be more intelligible it is sometimes necessary to use trade names of products or equipment, rather than complicated descriptive or chemical identifications. In so doing it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended, nor is criticism implied of similar products which** are not mentioned.