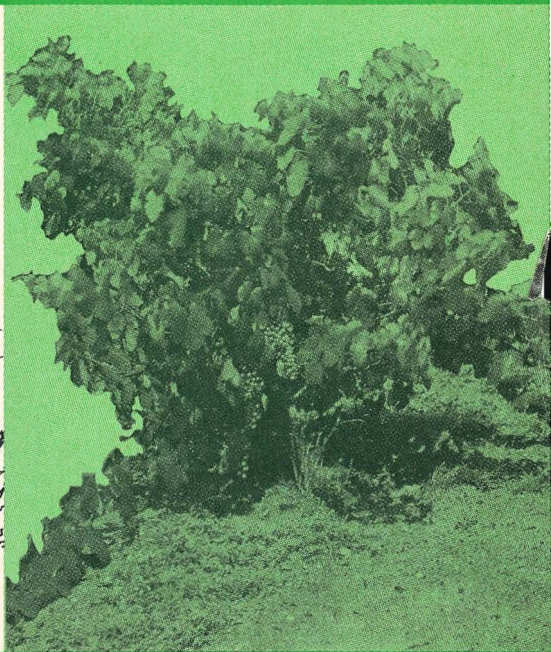




Division of Agricultural Sciences
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WEED CONTROL



IN GRAPES

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Weed Control in Grapes

INTRODUCTION

The French plow is used to control weeds under vines in many California vineyards, but it has serious disadvantages. It leaves islands of weeds close to the vines, and the plow itself can injure vines. For these reasons considerable interest in controlling weeds by other methods has developed in recent years.



Weed control with French plow in a California vineyard. Note island of weeds around vine.

The registration of simazine and diuron (Karmex[®]) offers growers a new means of controlling annual weeds in vineyards. Applied as preemergence sprays these herbicides have been used for a strip control of annual weeds down the vine

row; Amitrole and paraquat aid control of annual weeds when in the seedling stage or later. Long-term studies now completed indicate no serious chemical soil-residue problem from continued use of these herbicides. However, established perennial weeds require other control methods.

Herbicides for annual weeds

Diuron and simazine are essentially unrelated chemicals, but their herbicidal properties in vineyards are nearly identical. Both are applied as wettable powders containing 80 percent active ingredients, and both are slightly soluble in water or oil. They are noncorrosive, nonvolatile, stable in storage, and of relatively low toxicity to humans, livestock, and pets. These herbicides are applied to soil surfaces and must be leached into the soil by rainfall or irrigation (excessive irrigation can leach them out, however).

Amitrole and paraquat have properties quite different from those of diuron or simazine. They are water soluble and must be applied to foliage to be effective against weeds. They may be combined in the spray mixture with simazine or diuron to control emerged weeds. *Amitrole is only slightly toxic to animals, but paraquat must be handled with care as it is toxic to man and animals when taken internally.*

The phytotoxicity of diuron and simazine is not the same on all species of weeds. For example, diuron is less effective than simazine on wild oats and groundsel, but is more effective than simazine on crabgrass and barnyard grass. The problem of weed species resistance can be partly resolved by alternating the use of these herbicides from year to year.

How they work

Diuron and simazine are not toxic to weed seeds until the seeds begin to germinate. Weed seedlings pick up the herbicides through their roots, and if the herbicides are applied and leached into the soil prior to germination they prevent the establishment of most annual weeds.

At 2 to 5 pounds per acre (80 percent active ingredients) diuron and simazine in soil are effective against germinating weed seedlings from 3 months to a year or more, depending upon soil type, temperature, and moisture. Both herbicides are ultimately broken down



Complete annual weed control with simazine or diuron. Note shape of beds in vine row.

by soil microorganisms; this happens faster in warm, moist soils. These herbicides are generally ineffective in controlling well-established annual or perennial weeds.

Amitrole is picked up by the foliage and transported throughout the plant, and is most effective against young weeds. This herbicide is broken down by microorganisms in 2 to 3 weeks in warm, moist soil but considerably slower in cold or dry soils.

Paraquat kills green foliage but is not transported through the plant. It is most effective against young weeds. This herbicide is tied up in the soil and is slow in decomposing. Paraquat may injure young vines if sprayed on immature, green stems.

Application rates

The amount of diuron or simazine needed to prevent establishment of weeds, and the length of time the herbicides will be effective, depends upon the weed species present, the amount of rainfall and irrigation, and the amount of clay and organic matter in the soil. Highest dosages of herbicide are required on clay soils containing much organic matter, in rainy areas, or on soil irrigated frequently. When diuron and simazine

are leached into the soil a certain percentage is adsorbed on clay particles and organic matter. The adsorbed chemicals are unavailable for absorption by seedling roots.

When applied prior to weed-seed germination, both simazine and diuron control most weed species. For banded treatment, simazine (80 percent active ingredient) at 2 to 6 pounds per treated acre is recommended; frequently, 2 to 3 pounds of this herbicide will give adequate weed control. On some sandy soils, 1.25 pounds per acre has been sufficient to give control the second year of application. Diuron (80 percent active ingredient) at 2 to 4 pounds per treated acre is recommended. In subsequent years, 2 pounds per acre of diuron may be sufficient to give weed control; if not sufficient, it would be best to switch to simazine for one season. Although diuron generally gives good selective weed control, it is somewhat less safe than simazine, particularly in light, coarse-textured soils low in organic matter.

Young seedling weeds which germinate in the winter while vines are dormant can be controlled by adding 1 pound of amitrole or 1/2 pound of paraquat per acre to the simazine or diuron sprays. These combinations give excellent knockdown and residual control of such annual weeds but are ineffective on perennial weeds. A wetting agent (surfactant) should be added to the amitrole or paraquat at 1 quart per 100 gallons of spray solution.

Injury to grape vines can result from excessive applications of simazine or diuron. The injury is expressed first by the leaves becoming chlorotic and then turning brown on the margins; if extreme, the leaves eventually die, and new leaves will develop in their place. Careful application is necessary to prevent excessive rates especially on light sandy or gravelly soils. To prevent excessive soil contamination, care should be taken to shut off the sprayer when turning at the end of the rows, or while cleaning clogged nozzles, etc.

Diuron and simazine should be applied as a band treatment in the vine row from December 1st to March 1st on bearing vines 3 or more years old with trunk diameters of 1 1/2 inches or more. The rate per acre is based on the area actually sprayed, and not on the area of the whole vineyard. In general, the recommended amount of herbicide is applied in 60 to 80 gallons of water per treated acre.

Prior to first application of simazine or diuron, soil in the vine row should be tilled into a uniform, even ridge sloping slightly upward to the vines. This ridge should not be disturbed by additional seasonal cultivation in the row middles.

Treatments made prior to emergence of weed seedlings do not require the addition of amitrole or para-

quat. Application shortly before rainfall is desirable. Heavy trash on the ground, especially from previous years' weed growth, reduces effectiveness, and heavy cane growth found before pruning may interfere with uniform spraying.

Aromatic weed oils, or emulsions of these oils, can be used to control weeds; rates are 40 to 100 gallons per treated acre. Young weeds 1 to 2 inches high are most sensitive. Repeat applications may be required to keep weeds under control. Avoid spraying vine trunks.

Johnsongrass and bermudagrass

When Johnsongrass or bermudagrass is present in vineyards frequent discing down of the centers will keep these areas under control, but hand labor or herbicides will be needed to control them in the vine row. Dalapon is the only effective herbicide presently registered for this use—it will control both grasses if applied monthly (use 4 pounds of dalapon per 100 gallons of water containing 8 to 16 ounces of a surfactant or wetting agent).

Care should be taken to keep dalapon spray off grapevines, and excessive run-off of the spray onto the soil should be avoided. Dalapon should be applied soon after an irrigation to allow as much time as possible between the application and the next irrigation, as it is very soluble and can be leached into the soil and picked up by roots and transported to leaves. Injury also results from foliage application. Injury can be minimized by making spot applications rather than by spraying the entire vine row. Injury is expressed by a marginal chlorosis and a cupping of the leaves, shoot stunting, and clusters with shot berries.

Field bindweed control

Repeated discing of the center between the vine rows keeps bindweed under control, and the drier the vineyard the easier bindweed is to control in this fashion. However, discing does not control bindweed in the rows or around the vines' base. Repeated applications of weed oil have been used to keep bindweed partially controlled, but this can injure young grape vines. Paraquat, which is much safer if kept off foliage, is now registered and can be sprayed repeatedly in the same manner as weed oil. One-half to one pound per acre with a surfactant is sufficient to burn back bindweed and to control annual weeds in the row.

The most economical method of controlling field bindweed in vineyards employs an acid or amine form of 2,4-D. Great care should be taken to keep 2,4-D off the grape foliage, since leaf malformation and injury to developing clusters can result. It is considerably



Tractor equipped with hooded boom and flooding nozzles for 2,4-D application in vineyards.

safer (and recommended) to make applications after shatter following bloom, and to lift the trailing shoots of vines which might otherwise be sprayed. Spray drift can be appreciably reduced by using a hooded boom equipped with low-pressure, flooding nozzles which deliver coarse droplets. Bouncing of the boom can result in drift, so tractor speed should be adjusted to the terrain; speeds should not exceed 2 or 3 miles per hour. Spray 2,4-D only on days relatively free of wind, using 1 1/2 pounds of 2,4-D in 60 to 80 gallons of water per treated acre.

A permit to use 2,4-D must be obtained from the Agricultural Commissioner.

Weed control in young non-bearing vineyards

Annual weeds in new plantings can be controlled with trifluralin, which is incorporated as a preplant treatment 1 to 2 inches deep. Recommended rates are 1/2 pound of trifluralin per acre in sandy soil and 1 pound in heavier soils. Trifluralin can also be incorporated around young established vines if suitable application equipment is available, although there is some difficulty in obtaining adequate incorporation of the herbicide close to vines. Grape vines are relatively tolerant to this herbicide. Its only effect on the growth of a grape rooting appears to be to greatly reduce the branching of the roots in that part of the soil in which the trifluralin was incorporated.

How to apply

Diuron and simazine should be carefully weighed into the spray tank. Prepare a slurry of the herbicide by mixing it in a container with a small amount of water and adding it to the tank after it has been partially

filled with water and while the agitator is in motion. Continuous agitation is necessary to keep the material in suspension. Mechanical agitation is preferred, as hydraulic agitation may produce excessive foaming and part of the herbicide may be trapped in the foam. If agitation is stopped, make sure the herbicide is resuspended before continuing spraying.

Piston or centrifugal pumps are recommended for spraying wettable powders. Use hoses and booms with small diameters to keep the velocity high and prevent "settling out" of herbicide inside the hose or boom. Screens and strainers should be 50-mesh or coarser to prevent clogging.

The pressure at which the rig is operated should be accurately controlled, and its speed through the vineyard must be constant to obtain uniform coverage. Care should be taken to prevent localized overapplications as a result of double passes over the same row, momentary slowing of the rig, and while turning at ends of the rows. Turn off the sprayer before coming to a stop, and clean spray equipment with several rinses of water after using.

It is best to use a small "break-away" boom in making applications. This type of boom will swing backward when a vine is contacted and then immediately return to its original position. Nozzles giving a flat fan pattern of distribution are suitable. Hardened stainless steel disc-type nozzles last much longer than brass, although more expensive. Set them so there is a slight overlap at ground level—this overlap should not be excessive enough to result in partial double coverage. Moderate drift of simazine, diuron, amitrole, or trifluralin on to vines has not caused damage; however, it is recommended that the herbicides be kept off the trunks as much as possible. These herbicides are applied during the dormant season.

Paraquat and dalapon are applied mainly during the growing season, and care should be exercised to minimize drift. Paraquat causes dead spots on leaves or fruit where the droplets land. Drift of dalapon can cause symptoms, as already has been noted.

Since 2,4-D is applied mainly during the growing season, great care should be exercised to minimize its drift. This can be accomplished by employing hooded booms equipped with flooding nozzles, with a nozzle pressure of only 1 pound per square inch. Spraying should be done under low-wind conditions and at speeds sufficiently low to prevent bouncing of boom.

It should be remembered that sensitivity of the grapes to 2,4-D decreases with age of the shoots. Therefore, it is recommended that 2,4-D spraying be delayed until 2 weeks following flowering of the grapes to minimize the effects of accidental drift.

The calibration method

Herbicide application should be based on the area actually covered, and not on total acreage of vineyards.

A simple method of calibrating a spray rig for accurate application of an herbicide is to determine the amount of carrier (water, in this case) needed to cover a known area and then calculate the amount of herbicide to be added. To do this:

1. Measure a known distance over which to run the rig. Multiply this distance by the width of the boom swath. This will give the area covered.

2. Fill spray tank with a known amount of water. Drive the spray rig over the measured distance, *operating it at the same speed and pressure* at which the spraying is to be done in the vineyard.

3. Measure the amount of water left in the tank and, by subtraction, find out how much water was applied over the measured area.

4. From this figure, calculate gallons per acre applied and the amount of herbicide to be added.

Example:

Width of swath for one side of vine row = 2 feet
Measured distance for each 2 foot-wide swath = 2178 feet

Square feet covered for each 2 foot-wide swath = 4356 square feet, or $\frac{1}{10}$ acre.

If it is found that 7 gallons of water were used in the calibration run, then $\frac{7}{0.1 \text{ acre}} = 70$ gallons of water will

be applied per acre. Thus, if a 2 pound per acre herbicide rate is required, 2 pounds of herbicide should be added for every 70 gallons of water in the spray tank.

To determine the amount of water used in spraying, it is convenient to calibrate a stick with notches on it at 5-gallon intervals. This can be done by adding 5 gallons of water at a time to the tank and marking each level on the stick. Use of a measuring stick of this type allows the operator to measure accurately the amount of water in the spray tank.

All nozzles on the boom must deliver the same amount of liquid. Check each nozzle by measuring the amount of spray delivered in 1 minute and replace nozzles delivering excess material. Nozzles tend to wear with use of wettable powders, and as they wear they deliver larger volume.

The amount of water used per acre is not critical so long as adequate coverage is maintained. *The important thing is to apply a known quantity of herbicide over a known area.*

This information can be applied directly to the calibration of spraying equipment through the use of pre-calculated rate charts (shown below) supplied by nozzle manufacturers.

RATES OF NOZZLE APPLICATION WITH NO. 4 NOZZLES SPACED 20 INCHES APART ON BOOM

Pressure at nozzle in pounds per square inch	Delivery of nozzle in gallons per minute	Gallons per acre at various speeds		
		2 mph	3 mph	4 mph
25	0.32	47	31	24
30	0.35	51	34	26
40	0.40	59	40	30
50	0.45	66	44	33

Select nozzles to give the approximate rate of spray application desired at a practical speed and pressure. Corrections for different nozzle spacings and speed can be made on a ratio basis, as follows:

The spray equipment happens to have 2 nozzles spraying a swath 2 feet wide, spaced 12 inches apart. It is desired to apply 70 gallons per acre at a speed of about 3 miles per hour. In the table, Number 4 nozzles are used, and their delivery rate is 40 gallons per acre at 40 psi (pounds per square inch) at a speed of 3 mph when spaced 20 inches apart. With 12-inch nozzle spacing, the delivery rate would be $\frac{20}{12} \times 40$, or 67 gallons

per acre at the same speed and pressure. Since 70 gallons per acre is wanted, speed should be decreased to $\frac{67}{70} = 2.9$ mph. Thus the spray rig would be equipped with Number 4 nozzles, the pressure adjusted to 40 psi, and the sprayer driven at 2.9 mph to deliver 70 gallons per acre with 12-inch nozzle spacings.

REMEMBER

Established weeds are not controlled by diuron or simazine. When such weeds are present, amitrole or paraquat can be included in the spray mixture.

Continuous agitation in the spray rig is necessary.

Avoid excessive rates by spilling, overlapping, slowing, turning, and stopping.

Do not disturb soil after application of diuron or simazine.

Avoid drift of sprays. This consideration is of greatest importance in use of paraquat or 2,4-D during the growing season, but should be considered at other seasons as well. The grower is legally responsible for residues on his crops as well as for problems caused by drifts from his property to other properties or crops.

Spray rig should be calibrated in field to check accuracy of calculations.

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CAUTION

Legal limitations pertaining to the use of simazine, diuron, amitrole, dalapon, paraquat, trifluralin, and 2,4-D are subject to change. Information concerning their limitations is available from your local regulatory officials, through agricultural chemical trade channels, and from the University of California Farm Advisor's office. Restrictions will also be found on the manufacturer's label. Observe all precautions on the label regarding use of protective clothing and equipment, handling the chemical, storage of concentrates, and the protection of pets, domestic animals, wildlife, fish, and other crop plants.

To simplify the information, it is sometimes necessary to use trade names of products or equipment. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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