

WEEDS IN CALIFORNIA FRUIT CROPS

... a summary of problems and herbicide possibilities

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TABLE 1. PERCENTAGE OF FRUIT CROP TREATED WITH HERBICIDES 1965-1966

Crop	Crop acreage	Portion treated with herbicide
	In counties surveyed*	
	Acres	%
Strawberries	4,991	86
Lemons	16,065	81
Oranges	77,052	69
Grapefruit	12,285	55
Almonds	93,163	27
Bushberries	288	12
Grapes	391,326	12
Pears	21,129	10
Apples	20,895	7.5
Peaches	82,660	5
Walnuts	83,324	5
Cherries	1,686	2
Plums	10,911	2
Prunes	69,857	2
Figs	15,683	1
Olives	5,829	1
Nectarines	5,437	0.9
Apricots	23,134	0.7
TOTAL	940,715	

* From a 30-county survey.

TABLE 2. FIVE IMPORTANT WEEDS OF EACH FRUIT CROP

ALMONDS	ORANGES
Purslane	Bermudagrass
Bermudagrass	Spotted spurge
Puncture vine	Bindweed
Cheeseweed	Nutsedge
Johnsongrass	Puncture vine
APPLES	PEACHES
Bindweed	Johnsongrass
Pigweed	Barnyardgrass
Cheeseweed	Cheeseweed
Bermudagrass	Lambsquarter
Nutsedge	Fiddleneck
APRICOTS	PEARS
Bindweed	Bindweed
Barnyardgrass	Johnsongrass
Johnsongrass	Bermudagrass
Pigweed	Barnyardgrass
Purslane	Purslane
CHERRIES	PRUNES
Barnyardgrass	(PLUMS)
Cheeseweed	Bindweed
Fiddleneck	Johnsongrass
Dock	Barnyardgrass
Filaree	Bermudagrass
FIGS	Purslane
Bermudagrass	WALNUTS
GRAPEFRUIT	Bindweed
Bermudagrass	Barnyardgrass
Nutsedge	Johnsongrass
Spotted spurge	Pigweed
Bindweed	Lambsquarter
White hosenettle	Lambsquarter
GRAPES	BUSHBERRIES
Bermudagrass	Barnyardgrass
Johnsongrass	Pigweed
Bindweed	Lambsquarter
Barnyardgrass	Purslane
Pigweed	Cheeseweed
LEMONS	STRAWBERRIES
Bermudagrass	Cheeseweed
Barnyardgrass	Purslane
Spotted spurge	Lambsquarter
Bindweed	Pigweed
Nutsedge	Groundsel

ANUAL LOSSES resulting from weeds in California fruit crops have been recently estimated at almost \$50,000,000. About half of this amount represents weed control expenses, while the other half is accounted for by reduced crop yields resulting from weed infestations. Weed control costs vary from as little as \$6 for olives to as high as \$165 per acre for strawberries. Costs for weed control in an average deciduous fruit orchard were estimated at \$10 per acre, and losses from weed infestations, \$8 per acre.

Percentage treated

The highest crop percentage treated with chemicals for weed control was accomplished by strawberry growers who applied herbicides to 86% of the acreage, according to 1963-66 surveys by the Agricultural Extension Service. Treatments were mostly by soil fumigation with mixtures of methyl bromide or chloropicrin, used under plastic covering for both weed and disease control. The largest tree fruit acreage treated with chemicals for weed control was in the citrus industry, with an estimated 55 to 81% of the acreage currently treated with chemicals in various areas. Most of this treatment for weed control in citrus involved applications of simazine, diuron (Karmex), and monuron (Telvar)—plus weed oil used for spot treatment. More lemon and orange acreage has been treated than grapefruit. About 27% of the almond acreage was treated with herbicides for weed control (much of this acreage was treated with simazine before the label was withdrawn for use of this material in almonds). Grape acreage percentage treated was second (to almonds among deciduous fruits) with 12% of the acreage treated, mainly with simazine for annual weed control and weed oil for perennial weeds such as bermudagrass.

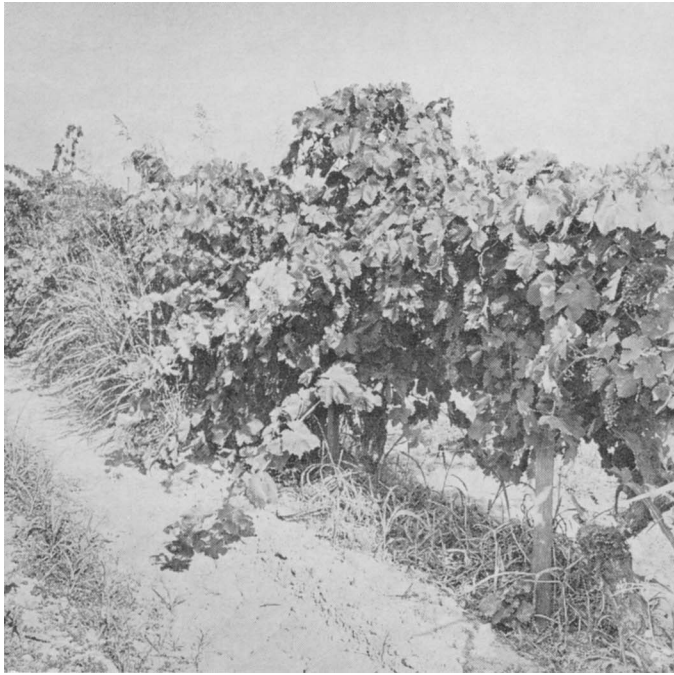
In a 1963-64 survey, annual weeds caused most of the problems in fruit

This report offers a brief summary of current herbicide usage and a review of the weed problems with reference to research results in California fruit crops. Herbicide weed control ratings of 70% or better in the tables are considered commercially acceptable. Listings of herbicides and rates in this article are not to be considered as University of California recommendations. There are many yet unregistered herbicides—and unregistered uses of herbicides—found effective in orchard research that are not discussed here. Current weed control recommendations are available at local county Farm Advisor offices.

crops, but during a 1965-66 survey perennials took the lead. Annuals such as cheeseweed, mustard, and winter grasses are the main winter and early-spring weeds. Barnyardgrass (watergrass), purslane, pigweed, and lambsquarter are important in the summertime. Purslane is a particularly serious problem prior to harvest in almond orchards throughout the state. Sandbur and puncturevine are troublesome in the southern California deciduous fruit orchards. In addition to sandbur and puncturevine, spotted spurge is a reoccurring problem in citrus (table 2).

Annual weeds

Weed problems vary from crop to crop depending upon the environment, soil, and the cultural practices of each crop. Where cherries and strawberries are grown, annual weeds are the main problem; whereas under the culture of many of the other fruit crops, bindweed is the number one problem. With citrus and grapes, the predominant weed is bermudagrass, but bindweed is another consistently important problem. Johnsongrass seems to be the most serious problem in peaches and is also important in many of the other tree fruit crops.



Johnsongrass control in grapes at the Kearney Field Station, Fresno County, is seen in vines to right (foreground) as compared with untreated strips to left, down the row.



Johnsongrass control in a Sutter County prune orchard showing some regrowth after first treatments. Note height of johnsongrass outside of the 10 x 10-ft plot around the base of the prune tree.

One of the most competitive pests of fruit crops is johnsongrass. It can be found in almost all the fruit-producing areas of California and is of critical importance in all orchard crops with the possible exception of almonds (probably because of the irrigation and cultivation practices in this crop (table 2)). Repeated applications of dalapon have given good control of johnsongrass in some, but not all, University of California trials.

Perennial weeds

The 1965-66 survey showed that perennial weeds such as bermudagrass and bindweed were becoming the major weed problems in orchards, replacing johnsongrass, which was listed as the number one weed in orchards in the 1963-64 survey. Bermudagrass is particularly bad where soil-persistent herbicides have been used. Repeated small applications of dalapon are still the most effective means of controlling bermudagrass. Single 10-lb-per-acre applications have generally not been effective. Frequent applications of weed oil can also keep this pest down.

Bindweed, on the other hand, is an ever-present problem in much of California agriculture. The best program recommended for this weed problem is 2,4-D (in crops where it is registered—apples, pears, and grapes). When used in repeated applications, 2,4-D has given good control of bindweed.

Nutsedge (nutgrass) also appears to

be on the increase. Nutsedge, both the yellow and purple species, found in many California orchards and vineyards is detrimental to the growth of young vines and trees. Nutsedge is usually shaded out in the more densely planted older orchards. It is one of the serious problems in a noncultivated, young citrus orchard because of the lack of competition from annual weeds. Bromacil (Hyvar X) offers some control of nutsedge (for citrus only).

White horsenettle is a perennial of increasing importance in some of the hotter areas of the west side of the San Joaquin Valley and in the Imperial Valley. Although marginal in effectiveness, repeated applications of 2,4-D including a wetting agent, has given control in many orchards and vineyards (where 2,4-D is registered).

There are several species of perennial dock infesting orchards in the Delta and other wet areas of the state. Dock in apples, pears, and grapes has been controlled with 2,4-D.

Vines

The vineyardists in many areas have readily accepted the use of herbicides for chemical weed control within the vine row. Since much of the California grape crop is raised on trellis and head pruned, chemical weed control offers the most feasible method of controlling weeds. However, according to the survey only

12% of the total acreage is currently treated with herbicides. In some counties such as Fresno, as much as 30% is treated. On most of the grape acreage the French plow is still used for weeds in the vine row. French plowing leaves something to be desired in total annual weed control costs and safety to the vineyard.

There is a growing interest among vineyardists in chemicals for weed control. Both diuron and simazine, particularly when combined with amitrole, and applied just after the spring weeds have emerged, are doing an excellent job for annual weed control but add little to the control of perennial weeds (table 3). When johnsongrass, bermudagrass, and bindweed persist, other chemicals must be used. Very little 2,4-D is used for bindweed control in grapes although it can be used safely in small, properly timed and repeated applications using a hooded boom.

Repeated small application rates of dalapon have also been highly successful in controlling bermudagrass and johnsongrass in California vineyards. Weed oil can be used safely with a good margin of control in established grapes, but care is needed to keep the oil off the trunks and foliage, especially in young vines.

About 12% of the bushberries are also being treated with simazine or diuron for annual weed control. Some injury has occurred on very young boysenberry vines growing in light soil.

More and more pears are being treated in California with recent recommendations of several herbicides by the University of California. As of the 1965-66 survey, only 10% were treated with herbicides such as simazine and amitrole for annual weed control. As in grapes, 2,4-D was used for bindweed control and dalapon for johnsongrass and bermudagrass. Extensive trials show that repeated treatments of dalapon at the 4 lb-per-acre rate are safer and give better perennial grass control than larger, more infrequent applications.

TABLE 3. HERBICIDES, RATES, AND GENERAL EVALUATION IN CALIFORNIA FRUIT CROPS SURVEY

Herbicides listed are registered by either Federal or State departments of Agriculture—but are not necessarily recommended by University of California. Current UC recommendations can be found in the Weed Control Handbook at local Farm Advisor offices.

Crop	Herbicide	Rates applied lb/A*	Effectiveness of herbicides† (%)
Almonds	Simazine	1-4	80‡
	Weed oil	40 gpa	50
Apples	Simazine	2-4	80
	Simazine	4+2	90
	Diuron	3.2	40
	2,4-D	2	60
	Weed oil	30-40 gpa	0
Bushberries	Simazine	2-4	80
	Diuron	4	90
Grapefruit	Simazine	2	70
	Diuron	2	70
	Weed oil	30-40 gpa	100
Grapes	Simazine	1-4	90
	Simazine and amitrole	2	80
	Diuron	1.6-3.2	90
	Dalapon	10 lb/ 100 gal	50‡
	Paraquat§	1/2-1	90
	Amitrole	1-2	90
	Weed oil	30-40 gpa	60
Lemons	2,4-D	2-3	70‡
	Simazine	2-3	70
	Diuron	2	70
	Monuron	2-3	70
	Weed oil	30-40 gpa	80
Oranges	Simazine	2-4	80
	Diuron	1.6-3.2	80
	Monuron	1.6-3.2	60
	Weed oil	30-40 gpa	100
Peaches	Simazine	2-3	80‡
	Simazine and paraquat§	2+1/2	80
	Dalapon	10	50‡
	Weed oil	30-40 gpa	80
Pears	Simazine	3-4	60
	Simazine and amitrole	4+2	80
	Dalapon	4-10	50
	Amitrole	1	90
	2,4-D	1-2	70
Prunes (plums)	Simazine	3-4	70‡
	Dalapon	10	50‡
	Paraquat§	1/2-1	70
Walnuts	Simazine	2-4	80
	Diuron	1.6-3.2	80
	Paraquat§	1	70
Strawberries DCPA	(Dacthal)	6-8	80
	EPTC	3	80‡
	(Eptam)	3	80‡
	Methyl bromide	120-275	90

* Pounds of active ingredient per acre (except as noted).

† Effectiveness at the rate listed: 0 = no effect; 100 = complete weed control. The percentages listed here, although averages, are only considered accurate to one significant figure and represent only an approximation of effectiveness. Any percentage below 70% would generally be considered commercially unacceptable.

‡ Phytotoxicity symptoms observed by one or more Farm Advisors.

§ State registration only (i.e., no federal registration for bearing trees or vines (as of this date).

Walnuts

Although several herbicides are registered and recommended for walnuts, only 5% of the acreage was treated in 1965-66. Some simazine and diuron are currently being used for annual weed control in walnuts, particularly around the trunks of the trees. Paraquat (registered in California but not yet recommended by the University of California) and oil are also used for spot treatment of annuals and perennials in walnuts.

Stone fruit and almond orchardists have not had the registered herbicides with which to work. Soil-persistent herbicides have shown more problems in experiments on stone fruits than on apples, pears, and walnuts. Some simazine has been used commercially in peaches and almonds but, according to the survey, very few herbicides have been used in apricots and cherries.

Some dalapon has been used successfully at low rates for johnsongrass control in prunes and peaches. Limitations in registrations and labeling presently place too many restrictions on the effective use of dalapon for perennial grass control in stone fruit orchards.

A small acreage of olives has also been treated, mostly with oil for johnsongrass and bermudagrass control. Simazine and diuron has been used for annual weed control.

Citrus

A comparison of monuron and diuron in citrus indicates a slight advantage for diuron. A summary of many years' work with these two herbicides indicates approximately equivalent weed control in a wide number of experiments with monuron being somewhat superior in certain areas and diuron in others. Simazine is also extensively used in citrus.

Although simazine and diuron have not been recommended by the University of California for use in bushberries, the results of the experimental work to date indicate good annual weed control except where summer grasses prevail; diuron has given as good if not slightly better weed control than simazine in bushberries. However, both herbicides produced injury to young vines and more research is needed.

Most of the strawberry acreage is fumigated with combinations of methyl bromide and chloropicrin. The methyl bromide is the predominant weed controlling agent in this mixture. At the lower rates of methyl bromide some of the hard-seeded weed species survive.

Combinations of simazine with either

paraquat or amitrole have shown good weed control in several tree fruit tests. Such combinations of herbicides in orchard crops to broaden the spectrum of weed control and to allow more flexibility in timing of application are becoming more popular. Combinations of simazine and amitrole and combinations of diuron and amitrole are registered, for example, in grapes, pears, and apples.

Trifluralin (Treflan) has given excellent weed control, particularly when incorporated in field experiments. (Trifluralin has only an experimental label for several orchard crops.) Considerable grass control has been obtained experimentally by using 2 to 4 lbs of trifluralin in the granular form. Trifluralin has not been very effective on the winter broad-leaf annuals and will probably only be effective in the control of summer weeds, primarily grasses, when used by itself. Combinations with simazine and dichlobenil are being studied.

Summary

Although limited, this survey report is intended to give a general picture of the important weeds present in orchard crops and the herbicides currently being used. More emphasis is needed on the control of perennial weeds, particularly in the tree fruits as more and more annual weed control is achieved by means of soil-persistent herbicides such as simazine and diuron.

A more liberal registration for use of 2,4-D is needed. Data and labels have been submitted for consideration by USDA. Similarly, more liberal registration (at least for strip treatment) for dalapon is needed for perennial grass control. The possibilities for the use of the organic arsenicals in orchard crops for the control of johnsongrass is being studied. The results to date indicate that these herbicides must be kept off the foliage to prevent herbicide residue in the fruit.

Additional varieties of tree fruits need to be labeled and registered for amitrole. Considerable performance and residue data have been submitted for USDA consideration on almonds, peaches, prunes, and apricots. FDA tolerances have recently been announced for use of paraquat in a number of tree fruits including almonds, apples, apricots, avocados, citrus, figs, grapes, macadamia nuts, nectarines, olives, peaches, pears, plums, fresh prunes and walnuts.

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