

# Roundup — The End of Perennial Weeds in Tree and Vine Crops?

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Anyone who has spent a summer in the San Joaquin Valley hoeing johnson grass, bermudagrass, or nutsedge (nutgrass) out of a young orchard or has labored on a hot summer afternoon trying to pull perennial bindweed out of a young vineyard or a cotton field will be much interested in Roundup (glyphosate). This new herbicide showed promise in earlier studies (*California Agriculture*, February 1973) and has since proved to be an outstanding product against most annual and perennial weeds.

Glyphosate's nonselective characteristic has great utility for non-crop weed control problems, but special precautions are required when the herbicide is sprayed selectively in crops. Field and green-

house studies to evaluate problems that may occur when glyphosate is sprayed on weeds growing in tree and vine crops have been conducted for the past 3 years throughout California.

The general conclusions thus far are that glyphosate, in direct foliar applications or through drift, causes fewer immediate symptoms but more actual plant damage than other translocated herbicides, including the oil soluble amine of 2,4-D. More damage to young peach and plum trees and to Thompson Seedless grapevines has been observed from glyphosate than from commercial formulations of MSMA (Daconate, Ansar, etc.), amitrole (Cytrol, etc.), cacodylic acid (Phytar), paraquat, or dalapon (Dowpon, Basapon, etc.).

## Tree and vine response

Based on foliar response, spray-applied glyphosate translocates rapidly in most plants and moves farther into the unsprayed portions of trees and vines than other translocated herbicides. Once inside, the herbicide slowly but surely kills plant tissue. Not all is known about how glyphosate does its damage. The usual symptoms are a fairly rapid wilting followed several days later by loss of chlorophyll. Sprayed

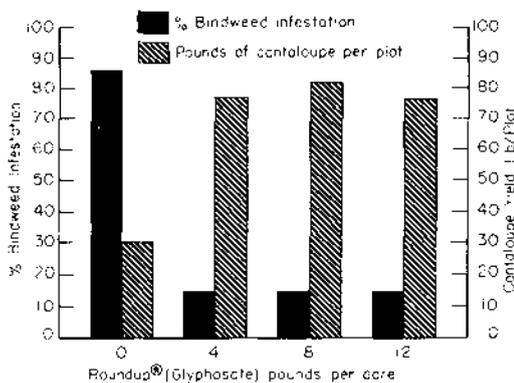
foliage yellows, and, in some plants, browns and dies. Regrowth in woody and some herbaceous perennial weeds is usually severely stunted. Severe injury in young plum trees resulted in a browning of the inner bark.

Tree and vine response to sublethal doses of glyphosate applied to foliage in UC studies appeared to center in the mechanisms that control bud growth. An apparent release of adventitious and lateral buds occurred, which suggests that the level of growth regulator was low at first, followed by extreme stunting in the subsequent surviving shoots.

A few weeks after shoot growth had begun in the spring, normal growth was well along (several inches to a foot long) on the untreated branches; a few shoots on treated branches (of the large number starting initially) developed and grew quite normally. However, most of the initially-released buds remained distorted and stunted with short, narrow strap-leaves. Some leaves turned brown and died. Some treated trees and vines recovered normal foliage 1 to 2 years after a sublethal dose. However, for a season or two total growth was greatly reduced.

Few observations have been made on the effects of glyphosate on flowering or fruiting. Some low rates of glyphosate on young tomato plants reduced fruit set, but in other tests on flowering grapes no effects on grape set were seen.

When one-third to two-thirds of the foliage of young established trees and vines were sprayed in the fall with normal use rates of glyphosate (2 to 4 pounds per acre), severe injury resulted, particularly in the following season's growth.



Roundup® applied 9/22/72  
Fruit harvested 10/1/73

TABLE 1. EFFECT OF SUCKER AND TRUNK SPRAYING WITH GLYPHOSATE ON THE CONDITION OF THE SUCKERS AND TOP GROWTH OF THE TREES.

Fruit	Average phytotoxicity*			
	Sprayed 4/14/74 and 4/27/74		Sprayed 8/4/74	
	Sucker	Top	Sucker	Top
Apple	0.0	0.0	5.0	0.0
Apricot	6.5	0.0	4.0	0.0
Almond	5.0	0.0	9.5	0.0
Nectarine	9.0	0.0	3.0	0.0
Peach	8.9	0.0	9.8	0.0
Plum	8.0	0.0	10.0	0.0

\*Average of four replications, where 0 = no effect, 10 = complete kill.

TABLE 2. EFFECT OF FALL TRUNK SPRAY ON SPRING NEW SHOOT REGROWTH OF THOMPSON SEEDLESS GRAPE VINES.

Herbicide <sup>1/</sup>	Rate (lb./A)	Average vigor of new growth <sup>2/</sup>
Glyphosate	4	9.0
Glyphosate	16	9.0
Glyphosate	64	5.5
2,4-D	4	6.2
2,4-D	16	6.2
2,4-D	64	4.7
MSMA	4	9.2
MSMA	16	9.0
MSMA	64	6.5
Check	--	10.0

<sup>1/</sup>Sprayed 10/8/74 in 50 gal./A on the bottom 12 inches of trunk; evaluated 4/30/75.

<sup>2/</sup>Average phytotoxicity, where 0 = no regrowth, 10 = no effect or most vigor.

TABLE 3. EFFECT OF FALL-APPLIED POSTEMERGENCE SPRAYS ON THE CONTROL OF SEEDLING AND VEGETATIVE PERENNIAL BINDWEED.

Herbicide	Rate (lb./A)	Date Sprayed	Average Bindweed control*	
			Seedlings	Vegetative
Glyphosate	4	8/31/74	6.8	9.8
Glyphosate	8	8/31/74	8.8	9.8
2,4-D	4	8/31/74	6.2	8.0
2,4-D	8	8/31/74	7.0	7.0
glyphosate	4	11/8/74	4.5	10.0
2,4-D	4	11/8/74	6.2	9.5
Check	--	--	2.5	1.5

Conclusion: Translocated herbicides are destroying the viability of some of the seed.

\*Average of four replications, where 0 = no control, 10 = complete kill of spring regrowth. Evaluated 3/7/75. Seedlings in the two- to four-leaf stage; vegetative, 5 inches to 2 feet long.

Spraying a small portion of the foliage of bearing trees injured the sprayed branches, but no injury occurred in other parts of the tree.

When 2,4-D was sprayed on the tips of vines, it did not move up into the vine. But when glyphosate was used, injured buds were observed the entire length of the vine the following spring.

Glyphosate applied to young newly planted trees and vines at bud break caused injury to treated buds and some injury to untreated buds toward the tips of the branches.

Unlike foliar treatments, glyphosate applied at 2 to 4 pounds per acre to basal suckers of 3- and 4-year-old trees has not visibly moved into the foliage of the tops of the trees (table 1). Basal application of glyphosate to well-developed bark on tree trunks has not caused visible damage except at very high rates (64 pounds per acre). However, rates as low as 4 pounds per acre applied to young green and, in some cases, to light-brown immature tree branches and trunks have caused severe burn, splitting, and exudations. Because of these findings, a great deal more information is needed on the limitations of this excellent new herbicide.

Normal use rates of glyphosate sprayed on the basal bark of newly planted trees and vines (this bark is relatively thin) injured some tree species, particularly peach, apple, and pear, in 1972 trials. When this work was repeated in 1973, little observable injury occurred. However, growth was significantly reduced by a 21-pound-per-acre rate on some species, including French prune on Marianna 2624 and Santa Rosa on 29 C. To a lesser extent, total growth of pomegranate, Malling 7 apple, and Fay Elberta peach on Nemaguard was reduced.

In 1974, the only species injured were Thompson Seedless grape rootings and Fay Elberta peach on Nemaguard. Rates of 3 and 12 pounds glyphosate per acre were applied to the basal 4 to 6 inches of peach trunk in some plots; in others the same rate was applied to the soil only (the trunks were shielded). No stunting occurred when only the soil was sprayed, which suggests glyphosate uptake was through the sprayed trunks. In young grapes, some uptake through branches and buds probably occurred because of

the low profile of the young rootings when sprayed shortly after planting.

In another test, when the trunks of 3-year-old trees and vines were sprayed (12 inches of trunk) in the fall of 1974 with several rates of glyphosate, the trees and vines showed some effects at 64 pounds per acre but no significant effects at 4 or 16 pounds per acre the following spring (table 2). In the same test, 2,4-D at 4 to 64 pounds per acre significantly stunted the spring growth of vines.

#### Weed control

Additives, such as nonphytotoxic oil, X-77 surfactant, Vistik (a thickening agent for reducing drift), a low rate of paraquat, and urea dissolved in the spray solution, have not appreciably altered the activity of glyphosate in controlling bindweed. On the other hand, the addition of X-77 to low rates of glyphosate improved the kill of bermudagrass.

Late fall applications (11/8/74) on bindweed were as effective as those in late summer (8/31/74) when evaluated the following spring (table 3). However, the earlier applications appeared to prevent the formation of viable seed. Early spring and some fall treatments on bindweed were ineffective in other field trials.

No residual effects on annual crops or weeds were observed in the soil 3 and 4 months after surface glyphosate application, with or without mechanical incorporation, even where as much as 16 pounds per acre were used in the field.

Although fall applications of glyphosate on vigorous perennial weeds have generally given good results, treatments must be made before the perennial weed foliage is severely injured by insects, lack of soil moisture, or early fall frosts. In one trial on perennial bindweed treated in September 1972, control in the spring of 1973 made it possible to harvest a normal crop of melons that summer (see graph). Control, however, has been somewhat variable on bindweed. The control of vigorously growing bermuda or johnsongrass is much more dependable.

Using a hooded sprayer to apply glyphosate to bindweed in cotton resulted in normal crop growth and

may prove to be advisable in vineyards and other crops. However, timing is critical in these types of applications and may prevent growers from using such a technique successfully.

#### Conclusion

We have long needed an effective translocated herbicide to control perennial weeds, particularly in perennial crops. We now have an excellent candidate — glyphosate. But the same characteristics that make this valuable new tool effective against perennial weeds make it potentially hazardous to desirable plants. We must treat glyphosate with the respect it deserves, fully understanding its limitations. Selective use in crops has been demonstrated. The appropriate information for labels is being developed. When the complete package is marketed for use in orchards and vineyards, it will be necessary to read the label carefully and utilize all available information to ensure selective weed control.

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