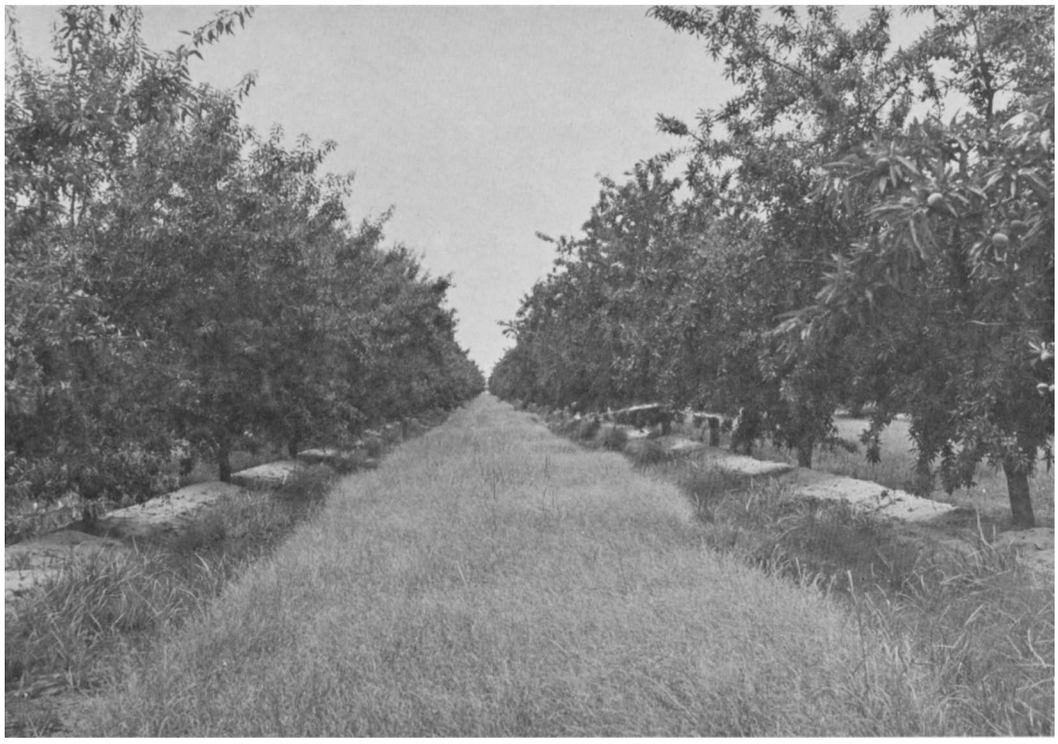
PROMISING HERBICIDES CALIFORNIA



Weeds controlled down the tree row with preemergence herbicides applied before winter weed growth. The interspace is a cover crop of mowed weeds which prevent erosion, allow winter travel in the orchard and aid in water penetration.

A. LANGE · B. FISCHER
C. ELMORE · H. KEMPEN
H. AGAMALIAN

THE NEAT ROWS OF WHITE AND PINK blooming trees in the San Joaquin and Sacramento valleys will have a new look this spring. Strips of brown soil bordered by green interspaces may be seen down many of the tree rows. These weed-free strips will probably be the result of herbicides applied before the rainy season and prior to weed emergence.

Princep (simazine), a soil active herbicide, is usually applied before the winter rains and therefore prior to weed growth. When the weeds have already come up after the rains, paraquat is most used to make the clean, weed-free strip of soil. Farmers find these and other herbicides more convenient and less expensive than cultural and mechanical methods. Where herbicides can be strip-sprayed in newly planted orchards, weed competition is minimized and the incidence of dead trees and trees damaged by rodents, diseases and misdirected discs is reduced.

California has a wide variety of soils with varying physical characteristics. Some soils soak up and deactivate herbicides. These adsorptive soils require a large amount of herbicide. Other (non-adsorptive) soils allow herbicides to readily dissolve into the soil solution at relatively high concentrations. These differences in soils result in problems such as the injury to young trees sometimes seen in midsummer.

Generally, the soils of the Sacramento Valley are of the adsorptive type. In these soils, herbicide foliage symptoms are rarely seen. In the soils of San Joaquin Valley, and to a greater extent the southern San Joaquin, herbicide symptoms are more common—occasionally becoming excessive under sprinkler and flood irrigation. Some of these soils are considered "hot," and herbicides must be used carefully at lower per-acre rates in these areas.

Because of the many acres of soils low in organic matter in California, Princep (simazine) and a number of other herbicides have not been generally recommended for stone fruits and almonds (i.e., trees of the plant genus *Prunus*). On the other hand, Princep has been safely applied at low rates in a direct spray at the base of young nursery trees of this group. In other experiments, excellent growth and minimum symptoms have occurred under sprinkler, flood, and furrow irrigation; however, safety can only be positively determined where sufficient field experimentation has preceded the use of Princep in stone fruit and almonds in a particular soil.

For several years, new herbicides have been tested at the San Joaquin Valley Agricultural Research and Extension Center (near Reedley); at U.C., Davis; at the Citrus Experiment Station, Riverside; and in a number of commercial orchards in the fruit growing areas of California. From this massive testing program has come season-long weed control with combinations of Princep at very low rates, and Treflan (trifluralin) or Planavin (nitralin) at somewhat higher rates. These combinations have been particularly successful when Treflan or Planavin were incorporated. Under sprinkler-irrigation, surface-applied Planavin has

TABLE 1. PHYSICAL PROPERTIES OF THREE NEW HERBICIDES COMPARED WITH SIMAZINE AND TERBACIL

Herbicide	Water solubility	Vapor pressure*
	ppm	mm of Hg.
Simazine	5	6.1×10^{-9}
Terbacil	710	"non volatile"
R-7465	70	2×10^{-3}
San-6706	10.5	1×10^{-6}
RP-17623	"insoluble"	"low"

* Vapor pressure from literature at temp. nearest to field conditions.

TABLE 2. PREEMERGENCE WEED CONTROL UNDER SPRINKLER AND FLOOD IRRIGATION AT TWO LOCATIONS

Herbicide	lbs ai/A‡	Average per cent weed control			
		Location 1*		Location 2†	
		summer	winter	spring	fall
		1 mo	1 mo	4 mo	10 mo
		%	%	%	%
Simazine	0.5	—	82	—	—
"	1	—	97	87	40
"	2	—	100	97	60
"	4	—	—	—	—
Terbacil	0.5	—	81	—	—
"	1	—	93	—	—
"	2	—	97	87	53
"	4	—	—	90	73
R-7465	0.5	79	81	—	—
"	1	93	93	—	—
"	2	97	97	—	—
"	4	—	—	93	83
San-6706	0.5	77	81	—	—
"	1	93	93	—	—
"	2	99	99	—	—
"	4	—	—	—	—
RP-17623	0.25	97	93	—	—
"	0.5	100	100	—	—
"	1	100	100	—	—
"	2	—	—	100	43
Check	0	0	0	0	0

* Location Number 1: OM 0.7%, Sand 69%, Silt 22%, Clay 9%, 1969 Fall and Winter weeds: Malva pariflora, Brassica nigra, Polygonum aviculare, Chenopodium album, Chenopodium murale, Sisymbrium irio, Phalaris arundinoceae, Avena fatua, Poa annua, Lolium multiflorum. Trial 1 = summer; Trial 2 = winter (one month after application).

† Location 2: OM 0.6%, Sand 67%, Silt 24% and Clay 9% 1969 Spring and Summer weeds: Setaria sp., Physalis sp., Echinochloa sp., Digitaria sp., Amaranthus sp., Chenopodium sp. One trial rated spring and late fall.

‡ Lbs active ingredient per acre

NEW FOR ORCHARDS

Young Mission almond tree in its second leaf. R-7465 was applied at four times the rate necessary for season-long weed control with no indication of phytotoxicity.

also been effective without mechanical incorporation.

Three new numbered selective herbicides which have now been under study for three years, have also been found to have a much improved margin of safety (table 1). Their margin of safety, on trees under severe test conditions was found to be nearly four times the rate required. All are selective; i.e., they control many weeds, but not all. Therefore, their use will depend on registration, price, and the weed spectrum they control. Because these new herbicides are more selective than older herbicides, they will probably be used alone or in combinations with other herbicides.

The most promising of this group is R-7465, a long-lasting preemergence herbicide (tables 1 and 2), with a good margin of safety on young stone fruit trees (table 3), and grape cuttings. R 7465 is particularly selective (safe to use) on the plant family *Solanaceae*. It shows some safety on tomatoes and on peppers. Because of this safety, it fails to control nightshade, groundcherry, and *Datura*, all in the family *Solanaceae*. Scarlet pimpernel and a weed related to cotton, cheeseweed (*Malva parviflora*), may also be resistant. After widespread use of these new herbicides, more weed species will be found to be resistant. Combinations with other herbicides will be necessary for season-long weed control.

R-7465 is primarily effective on annual broadleaf weeds and annual grasses. However, it also controlled nutsedge (*Cyperus esculentus*) successfully in a number of field trials conducted in soils with low organic matter.

Another long-term residual herbicide with a broad spectrum of weed control is San-6706. This experimental herbicide, like R-7465, is selective on some plant families. It is particularly safe on cotton (*Malvaceae*) and plants in the poppy family (*Papaveraceae*) San-6706 is also weak on filaree and pigweed. San-6706, like R-7465, has a good margin of safety for orchard trees, being twice to three times safer than necessary when used for weed control on trees of the genus *Prunus* (table 3).

The third outstanding new herbicide for pre- and postemergence annual weed control in young orchard trees is RP-17623 (table 1). Like the former two experimental compounds, it has a wide spectrum of preemergence weed control and a wide margin of safety, with the possible exception of Tilton apricot. (Further testing will be necessary to re-evaluate RP-17623 on varieties of apricots.) RP-17623 shows promise for use on beans, potatoes, celery, carrots, onions, and peanuts.

These three new experimental herbicides, along with other new products of herbicide research, continue to be tested, since several years of experience are necessary to properly evaluate an herbicide for use in California orchards. In the last seven years of testing herbicides for use in stone fruits and almonds, R-7465, San-6706, and RP-17623 rate well above their nearest competitors.

TABLE 3. EFFECTS OF THREE NEW HERBICIDES ON TRUNK GROWTH OF YOUNG PRUNUS SPECIES ORCHARD TREES AS COMPARED WITH SIMAZINE AND TERBACIL WHEN USED FOR ANNUAL WEED CONTROL IN A FLOOD IRRIGATED ORCHARD WITH SANDY LOW ORGANIC MATTER SOIL*

Herbicides†	lbs ai/A‡	Average increase in diameter of trunk in mm.†							
		Almond Texas	Almond Nonpareil	Peach Halford	Plum Santa Rosa	Prune French	Cherry Bing	Apricot Royal Blenheim	Apricot Tilton
Simazine	4.0	6.3	6.6	11.3	10.6	4.0	5.6	7.0	7.5
Terbacil	2.0	11.6	12.6	14.6	18.0	4.6	0	9.0	7.6
Terbacil	4.0	1.0	2.6	4.3	2.6	0	0	0	0.3
Terbacil	8.0	0.3	0	0.6	4.3	0	0	0.6	0
R-7465	4.0	19.0	10.6	17.0	15.0	10.3	9.3	9.0	7.3
R-7465	16.0	14.0	10.6	17.0	13.6	9.6	12.3	9.3	10.6
San 6706	1.0	10.0	11.0	15.0	11.0	9.3	9.0	12.3	10.3
San 6706	4.0	13.3	10.0	16.0	14.3	13.0	8.6	11.3	11.6
RP-17623	4.0	14.3	12.3	15.0	12.3	13.6	7.0	8.6	11.3
RP-17623	16.0	12.3	10.6	18.0	17.3	9.3	6.0	10.0	7.0
Untreated	—	10.5	10.6	16.0	12.0	7.6	8.0	9.6	10.3

* Trees planted: 25 March 1969; Herbicide applied: 15 April 1969. OM = 0.6, Sand = 67%, Silt = 24%, Clay = 9%.
† Average increase in trunk diameter in mm. measured 6/16/69 and 12/3/69. Average of 3 replications.
‡ Lbs active ingredient per acre

A. Lange is Extension Weed Control Specialist, University of California, Riverside; C. Elmore is Extension Weed Specialist, University of California, Davis. B. Fischer, H. Kempen, and H. Agamalian are Farm Advisors in Fresno, Kern, and Monterey counties respectively. *Assistance was provided by the Stauffer Chemical Company; the Sandoz-Wander Inc. (especially through Mike Lavelleye); the Rhodia Chemical Company; Jim Yeager, Department of Pomology, U. C., Davis; Farm Advisors Leonard Buschmann, Thomas Aldrich, and Dave Holmberg. Also contributing to this study were Agricultural Experiment Station superintendents and staff members at the San Joaquin Valley Agricultural Research and Experiment Center, Reedley, and at U. C. Riverside and Davis campuses.*