Test plot photo shows sorghum plants killed at germination during a long time herbicide residue study, Kearney Horticultural Field Station.

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HERBICIDE RESIDUES

under different cultural practices

THE RESIDUAL CHARACTERISTICS of common herbicides in California have been studied for over seven years at various locations throughout California from Tulelake in the north to El Centro in the south. The many differences in crops, soils and climates, cause great differences in the length of time soil-applied chemicals remain active.

The main factors influencing the breakdown of a specific herbicide (which can be altered by cultural practices) are the methods of incorporation and the amount of soil moisture. Other factors such as light, temperature, microbial breakdown, organic matter, and clay content of the soil cannot usually be manipulated.

In the study reported here, incorporation by power tiller was compared under sprinkler and furrow irrigation. Preemergence applications and use of sprinklers were also compared with incorporation under sprinkler and furrow irrigation at the West Side Field Station near Five Points, California. The soil analysis showed 2.8 per cent organic matter, 24 per cent sand, 44 per cent silt and 31 per cent clay.

Herbicides were applied on December 17, 1968. Twenty treatments were incor-

TABLE 1. A COMPARISON OF HERBICIDE RESIDUES UNDER SPRINKLER AND FURROW IRRIGATION
(Average rating of all crops—minus checks—3 replications per treatment)

Herbicide		Sprinkler irrigation						Furrow irrigation		
		Mechanical incorp.			No incorporation			Mechanical incorp.		
	lbs/A	4 mo.*	8 mo.†	12 mo.‡	4 mo.*	8 mo.†	12 mo.‡	4 mo.*	8 mo.†	12 mo.‡
		Ratings§								
Trifluralin	1	2.4	0.0	0.2	1.4	1.6	0.0	2.5	2.0	1.1
Trifluralin	4	6.4	1.9	2.4	2.6	0.2	0.7	4.6	2.4	2.8
Nitralin	1	3.8	0.3	0.2	2.8	1.4	0.4	2.2	1.0	1.1
Nitralin	4	7.4	5.2	1.2	6.5	2.2	0.2	6.1	4.1	1.9
Prometryne	1	1.8	0.8	0.2	0.41	0.2	0.1	1.0	1.1	0.2
Prometryne	4	0.8	0.1	0.1	0.45	0.1	0.4	1.4	0.1	0.3
Diphenamid	4	1.5	1.5	0.0	1.2	0.4	1.0	1.9	0.3	0.5
Diphenamid	16	0.7	0.8	0.1	2.3	0.1	0.1	2.0	1.2	0.6
Pyramin	4	. .	. .	. .	4.5	1.5	0.1	5.7	4.4	1.5
Pyramin	16	. .	. .	. .	8.2	3.5	0.3	8.1	7.2	2.5
DCPA	8	5.1	1.1	0.1	2.6	1.5	0.6	4.7	2.9	0.1
DCPA	32	7.6	2.8	0.8	5.0	3.1	0.3	5.7	3.0	1.6

* Crops: barley, milo, lettuce, sugar beets, broccoli, tomatoes.
† Crops: barley, milo, cotton, tomatoes.
‡ Crops: barley, canary grass, safflower, sugar beets, lettuce, carrots.
§ Ratings: 0 = no effect on crop plant; 5 = half a stand or ½ size; 10 = all plants dead or missing.

porated to a depth of 4 inches with a straight tooth power-driven rototiller. Twenty-one other herbicide treatments were left on the surface and sprinkler-irrigated immediately after application. Eighteen treatments received mechanical incorporation and sprinkler irrigation. Four months after herbicide applications, six crops were planted and then evaluated on May 13, 1969. Eight months later four new crops were seeded, allowed to grow for about a month, and then evaluated. One year after application, six crops were again planted and evaluated by phytotoxicity ratings.

Phytotoxicity

Phytotoxicity readings indicated a wide difference between residual characteristics of the herbicides tested. Some herbicides evaluated under the different cultural methods showed considerable differences in residual characteristics due to cultural practices. The crops used for evaluation varied greatly in their sensitivity to herbicide residues.

Trifluralin showed essentially no residue when applied to the surface and sprinkler-irrigated, however, when this herbicide was mechanically incorporated, and then sprinkler- or furrow-irrigated, some residual effect on test plants resulted (table 1).

Nitralin showed similar residual effects (particularly on susceptible crops) as trifluralin, except under sprinkler irrigation where considerably greater residual effects were observed at 4 months than with trifluralin. The amount of residual activity under sprinkler irrigation had largely dissipated by 8 months.

DCPA

DCPA (dacthal) like nitralin showed some residual effects at exceedingly high rates (i.e., 32 lbs per acre) under sprinkler irrigation and slightly more when mechanically incorporated.

Diphenamid and prometryne showed very little residual effects under any method of incorporation at four months after herbicide application.

Results with pyrazon (Pyramin) showed considerable residual effects at the high rate after 4 months when applied to the soil surface, and when sprinkler irrigated. However, with mechanical incorporation, considerable crop injury was observed even at 4 lbs and 8 months. By one year, most of the pyrazon had dissipated. These results are consistent with two previous residue trials in the same soil (West Side Field Station).

At rates of 256 lbs, MSMA showed some slight phytotoxicity particularly on barley at 4 months, but virtually none at 8 months. No phytotoxicity was observed at rates of 16 to 64 lbs (table 2).

TABLE 2. A COMPARISON OF THE RESIDUAL CHARACTERISTICS OF THREE POST-EMERGENCE TYPE HERBICIDES IN AGRICULTURAL SOILS (Average rating of all crops—minus checks—3 replications per treatment)

Herbicide	lbs/A	Sprinkler irrigation, No mechanical incorporation		
		4 mo.*	8 mo.†	12 mo.‡
		Ratings§		
2,4-D	16	0.9	0.0	0.2
2,4-D	64	1.4	0.1	0.2
Dalapon	16	1.1	0.3	0.1
Dalapon	64	1.4	0.0	0.0
MSMA	16	1.2	0.6	0.6
MSMA	64	1.6	0.3	0.2
MSMA	256	3.1	0.4	0.2

* Crops: barley, milo, lettuce, sugar beets, broccoli, tomatoes.
† Crops: barley, milo, cotton, tomatoes.
‡ Crops: barley, canary grass, safflower, sugar beets, lettuce, carrots.
§ Ratings: 0 = no effect on crop plant; 5 = half a stand or ½ size; 10 = all plants dead or missing.

2,4-D and dalapon, like MSMA, showed very little phytotoxicity even at 64 lbs per acre 4 months after application. No residue was observed at the two later dates after application.

Conclusions

Herbicides responded very differently under furrow irrigation, where they were incorporated into the bed top, than under sprinklers where they were sprayed on the bed top and sprinkled into the soil. Much shorter residual effects resulted from surface application of trifluralin. Nitralin showed more residues on the soil surface than trifluralin.

Prometryne was essentially gone after 4 months. Dyphenamid showed only slight residual effects at four months. Pyrazon, on the other hand, lasted about 8 months, and like trifluralin, caused less residual effects when incorporated by sprinkler irrigation than by power tiller. DCPA showed less residual effects on the soil surface than when incorporated, even at high rates, but effects lasted only about 4 months when incorporated.

Three post-emergence herbicides commonly applied to the foliage of weeds showed essentially no residual effects on crops even at rates higher than the potential load on soil resulting from 4 to 16 years of continuous application.

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Imported Weevils Attack Punctureviné

WEEVILS imported by University and USDA researchers are slowly but surely reducing the thorny-seeded punctureviné to a lesser pest status in southern California. One of the two species imported from Italy attacks the stem and crown of the weed, while the other infests the fruit and destroys the seed. Richard D. Goeden, Assistant Professor of Biological Control, Department of Entomology, U.C., Riverside, said the weevils are constantly on the move, in search of the weed and that many punctureviné infestations in this part of the state will gradually and unspectacularly fade from the scene. Complete eradication is unlikely, but hopefully the number of plants remaining will be tolerable; if not, additional natural enemies may be imported. The process will be lengthy because the seed can live buried in the soil for at least eight years, probably for longer. The weevils diminish the plant numbers by reducing the amount of seed available for reproduction. Photo shows Goeden examining a punctureviné plant laid bare by the imported weevils in greenhouse tests.