

## EVALUATION OF MONURON AS A SELECTIVE HERBICIDE FOR USE IN AVOCADO ORCHARDS

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Noncultivation is almost a universal practice in California avocado orchards. Two types of noncultivation programs exist. The first allows a permanent weed sod to develop which is controlled by mowing. The second involves the complete eradication of weeds by means of oil or chemical sprays. At the present time, only oil, oil emulsions, and the careful use of 2,4-D are recommended for chemical control of weeds in avocado orchards.

In the past, repeated oil sprays have been used to control the majority of weed growth. During the first years in the establishment of a nontillage program, spraying must be done frequently and usually at greater cost than when conventional tillage methods are used. As the weed seed population of the soil surface is reduced, costs fall below those of other methods of weed control. Where weeds are eliminated there is also a saving of water and fertilizer.

This high initial expense, followed by low maintenance costs, is typical of noncultivation programs in all types of orchards where contact sprays are used for weed control. In citrus orchards this high initial cost has been greatly reduced by the use of the urea herbicide monuron [3-(p-chlorophenyl)-1, 1-dimethylurea] (1,2). Monuron is an herbicide of the soil sterilant type which, when used at low rates, will control germinating weed seedlings without injury to established citrus.

A program for the evaluation of monuron for use in avocado orchards is in progress. Weed control problems in avocado orchards do not differ to any great extent from those encountered in citrus orchards. Therefore this program is concerned only with studies to determine the tolerance of avocado trees to the herbicide and the accumulation of monuron residue in the fruit. Experiments carried out in the greenhouse indicate that avocados fall in the same range as citrus in their resistance to monuron. While no adverse effects have yet been observed in preliminary testing with monuron, it should be emphasized that this is a new material and the long-term effects which may result are as yet unknown.

Field tests were begun in November of 1955 in San Diego County using monuron at rates of 3¾, 7½, and 11¼ pounds of the commercial formulation (80 per cent active ingredient) per acre. No injury resulted from single applications at any of these rates. At the same time tests were established in Santa Barbara County at rates of 7½, 15, and 22½ pounds per acre. These treatments have been repeated on a yearly basis. In the

fall of 1956 rates of 24 and 32 pounds per acre were included in these trials. No symptoms of injury have been observed on any of these trees to date (June, 1957). In December of 1956 a series of tolerance tests at rates of 10, 20, 30, 40, and 50 pounds per acre were established on Hass, Rincon, Anaheim, and seedling trees. No symptoms of injury have yet appeared on any of these varieties. However, it is possible that injury may ultimately occur at the higher rates. Final evaluation of these tests will not be available for another year.

While there has been no injury from soil applications at the present time, drenching sprays on the foliage at the rate of 4 pounds of monuron per 100 gallons of water have caused burn on both young and mature leaves.

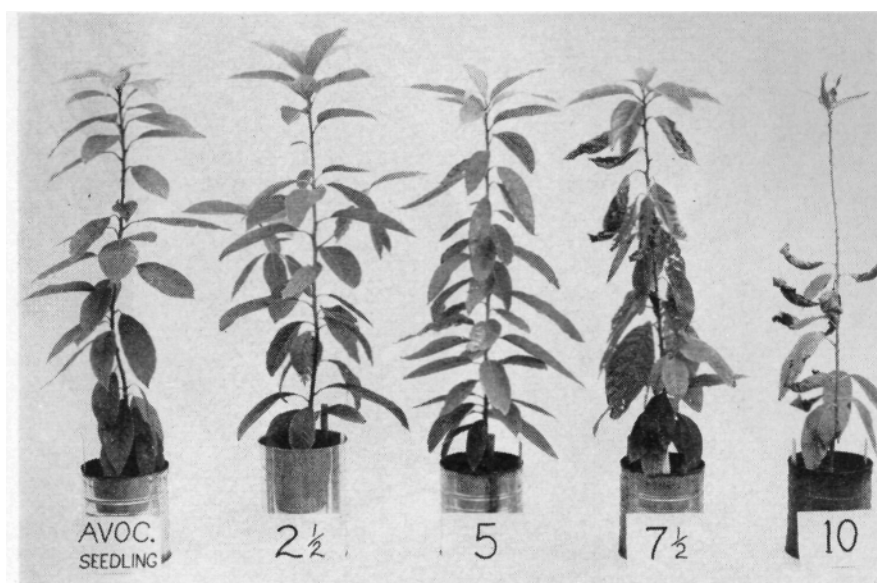


Figure 1.—Avocado seedlings treated with monuron at rates of 2½ to 10 pounds (active ingredient) per acre. Leaf drop occurred at the 7½-pound rate and up.

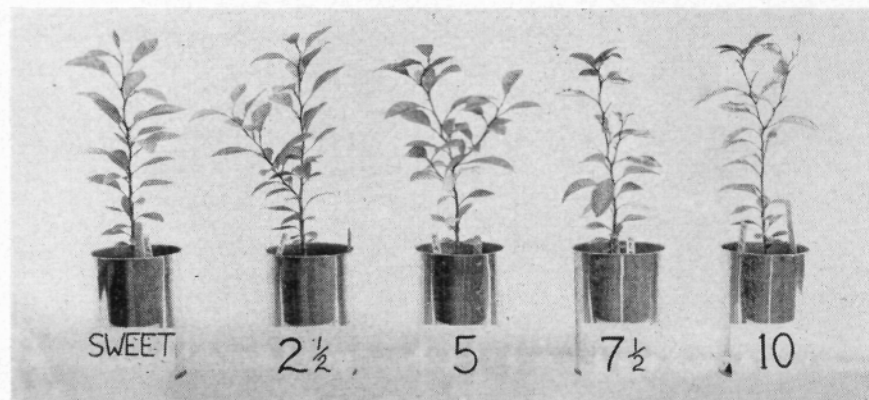


Figure 2.—Sweet orange seedlings treated with monuron at rates of 2½ to 10 pounds (active ingredient) per acre. Chlorosis and leaf drop occurred at the 7½-pound rate and up.

Field trials at 2 pounds per acre have been established for the collecting of residue data needed to fulfill the legal requirements as specified by the Federal Food and Drug Administration for the use of pesticides in agricultural crops. While not yet registered for use, conditions appear favorable for an early release of monuron for weed control in avocado orchards.

Only seedling weeds are killed by monuron at rates which appear to be safe for use in avocado orchards. Mature weeds are not affected. Established perennials such as bermuda grass, Johnson grass, and morning glory will thrive in a monuron-treated orchard due to lack of competition from other weeds. Some seedling weeds become resistant soon after germination. One species, turkey mullein, is resistant even in the early seedling stage. Spotted spurge and other species of prostrate spurge are only a little less resistant than turkey mullein. Puncture vine and common malva develop resistance soon after germination. Resistant species are the first to come back into the orchard following treatment.

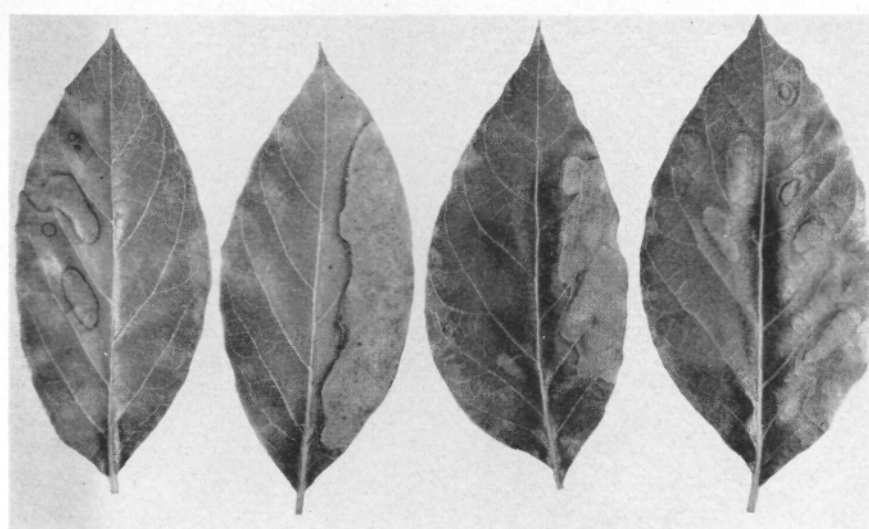


Figure 3.—Contact burn on mature avocado leaves resulting from a drenching spray of monuron at 4 pounds per 100 gallons.

The amount of monuron required to prevent the establishment of weeds depends upon soil type and the amount of organic matter present in the soil. In general, heavy clay soils and soils high in organic matter require larger amounts of monuron than do light or sandy soils. A 2-pound-per-acre rate will give good weed control in most of the avocado-growing areas of California.

In the soil, monuron is eventually broken down and destroyed by certain types of bacteria which use it as a source of food. This occurs most rapidly in warm moist soils where bacterial action is greatest. Monuron is also dissipated by leaching, and it is in the furrows of irrigated orchards that monuron first loses its effectiveness.

Under sprinkler irrigation monuron may be applied at any time during the year. If furrow irrigation is used, monuron should be applied in the fall just before the rainy season so

that fall rains will leach it into the soil. Under most conditions this will provide weed control throughout the winter months. Monuron may be applied again in the spring just before the end of the spring rains. In cases where control is holding up well, only the furrows need be treated at this time.

Monuron is a wettable powder and for all practical purposes insoluble in oil and water. It is nontoxic to warm-blooded animals and noncorrosive to spray equipment. It is nonvolatile and stable in storage. At rates of 2 pounds per acre of commercial formulation (80 per cent active ingredient) it is toxic to weed seedlings for periods ranging from 2 to 8 months depending on soil type, temperature, and amount of rainfall. At high dosages it is capable of causing injury, and accidental spilling of small amounts of monuron on the soil will result in sterilization of that area to plant growth for several years. It must be remembered that a weed control program of this type is based on the ability of avocado trees to tolerate low rates of monuron. Exceeding these rates, even in local spots, can result in serious injury.

SUMMARY OF TESTING PROGRAM FOR THE EVALUATION OF MONURON FOR WEED CONTROL IN AVOCADOS

Location (County)	Date	Variety	Rates*	Results	Remarks
San Diego	Nov. 1955	Seedling	3¼, 7½, 11¼ lbs./A	No injury	Application not repeated
Santa Barbara	Nov. 1955	Mexicola,	7½, 15, 22½ lbs./A	No injury	Repeated on a yearly basis
	Nov. 1956	Topa Topa			
Santa Barbara	Nov. 1955	Zutano Fuerte	15, 22½ lbs./A 7½ lbs./A	No injury	Trees pulled the following June to make room for hiway
Santa Barbara	Nov. 1956	—	30, 37½ lbs./A	No injury	Drenching spray (4 lbs./100 gals.) on foliage caused burn on mature leaves
Santa Barbara	Dec. 1956	Hass, Rincon Anaheim, Seedling	10, 20, 30, 40, 50 lbs./A	No injury at any rate to date (June 1957)	Injury expected at high rates
Ventura	Jan. 1957	—	2 lbs./A	No injury	Leaf and fruit samples taken at 30-day intervals for analysis
Ventura	Feb. 1957	Hass, Anaheim	2 lbs./A	No injury	"
Los Angeles	Feb. 1957	Bacon	2 lbs./A	No injury	"
Riverside Greenhouse Pot Tests	Fall 1956	Seedlings	3⅛, 6¼, 9⅜, 12½ lbs./A	Injury occurred at 9⅜ lbs. rate and up	Tolerance of potted avocados falls in same range as potted citrus

\*Rates expressed in pounds of commercial formulation of monuron (80 per cent active ingredient) per acre.

## LITERATURE CITED

- (1) Day, B. E. Urea herbicides for weed control. California Citrograph, Vol. 40, No.11, pp. 398, 408, 410-12, 414. Sept., 1955.
- (2) Day, B. E., Russell, R. C., McCarty, C. D. Monuron (CMU) for citrus weed control. California Citrograph, Vol. 41, No. 12, pp. 426, 436, 438, 440, 442. Oct., 1956.

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