

# Citrus Weed Control by Monuron

experiments with urea herbicides for weed control in citrus orchards encouraging but use of the chemicals is restricted

B. E. Day, R. C. Russell, and C. D. McCarty

**The urea herbicide, monuron**—3-(p-chlorophenyl)-1, 1-dimethylurea—formerly known as CMU, was registered with a federal residue tolerance of 1 ppm—one part per million—for limited use in Valencia and navel orange orchards during the fall of 1955.

It has been estimated that during the 1955-56 winter season, between 6,000 and 10,000 acres of California citrus were treated with monuron. Autumn applications of monuron at the rate of two pounds per acre have controlled germinating weeds until spring. Spring treatments at the two-pound rate have remained effective throughout the summer except in heavily watered areas of some furrow-irrigated orchards.

No instance of orchard-wide injury from monuron has been reported, but there have been a number of cases of injury to individual trees, apparently from spillage, equipment breakdown, or careless handling of the chemical.

In a few orchards, weed control with monuron has been only partial and of

short duration. In one instance the herbicide was applied in late September and rain did not fall for several weeks. Following rainfall, the herbicide became effective but for a relatively short period. There is evidence that in such cases of prolonged exposure on the surface prior to being leached into the soil, the ultraviolet rays of sunlight slowly decompose monuron, destroying its effectiveness. Once leached into the soil, the herbicide is protected from the destructive effects of light.

## Response of Weed Species

The nature of the weed population in an orchard is a major consideration in the use of monuron. Established perennial weeds such as wild morning glory, bermuda grass, and nutgrass—except in the seedling stage—are not controlled by the rates of urea herbicides used in orchards. Different species of annual and seedling perennial weeds vary in their susceptibility to monuron.

Annual bluegrass and most other annual grasses, chickweed and nettle are easily killed. Although urea herbicides are generally most effective by means of root absorption, these more sensitive plants may absorb lethal amounts through their foliage. A dosage of two pounds of monuron per acre controls chickweed in any stage of growth. Stands of annual nettle up to a foot tall are killed by spray treatments. Two-pound applications control annual bluegrass up to 6" tall and wild oats and foxtail when treated prior to tillering or stooling out.

Many weed seedlings become resistant to monuron very soon after germination, and one species—turkey mullein—is resistant even in the earliest seedling stage. Spotted spurge and other prostrate species of spurge are also relatively resistant to monuron. Puncture vine and common mallow develop resistance soon after germination. To control these more resistant species, monuron must be applied and leached into the soil prior to emergence of the seedlings. Resistant species are the first to come back into orchards following a treatment as the effectiveness of monuron gradually decreases.

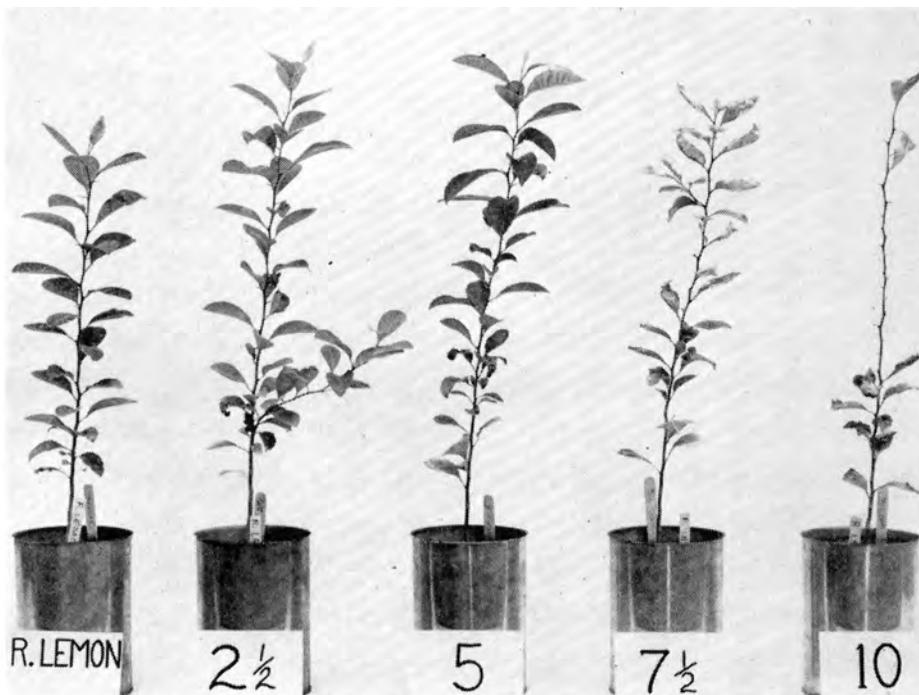
Although the more susceptible weeds are the predominant species occurring in California citrus orchards, usually there are resistant species present which limit the feasibility of postemergence spraying. For best results in most situations monuron should be applied to bare ground prior to the germination of weed seeds.

Before spraying with monuron, established stands of weeds may be destroyed with contact sprays such as weed oil or weed oil emulsion. If weed growth is young, it may be treated first with monuron to control the more susceptible species and later sprayed with oil to kill the surviving weeds of resistant species.

Oil, water, and monuron may be mixed and applied in one operation; however, weed oils vary in their compatibility with monuron. The suspended herbicide particles may flocculate to form oily granules which clog spray nozzles and interfere with uniform application. The granular sediment may be pumped through the spray equipment in

Concluded on next page

**Rough lemon rootstock seedlings treated with monuron at rates of two and one half to ten pounds per acre. Control on left. Chlorosis and some leaf drop occurred at the seven and one half pound rate. Almost complete defoliation occurred at 10-pound rate.**



## MONURON

Continued from preceding page

concentrated form causing overdosing and tree injury in local areas of the orchard and poor weed control elsewhere.

Flocculation may be prevented in most cases by the addition of calcium caseinate conditioner at the rate of one half pound per 100 gallons of emulsion. The monuron and conditioner should be thoroughly mixed with the water before addition of the oil.

Urea herbicides are less effective in soils high in organic matter. The chemical becomes absorbed to organic particles, reducing the amount available for absorption by plant roots.

To evaluate the effect of mulches, experiments were set up in the greenhouse—with oats in pots as the test plants—in which a number of organic materials were applied to potted soils and varying rates of monuron were added.

In tests with steer manure applied to the surface of the soil at rates of six to eight tons per acre, about twice as much monuron was required to kill oat seedlings as in soils without the manure. The dosage needed to kill oats was not appreciably affected by chicken manure at rates of from one to six tons per acre. The effect on dosage of half-inch layers of the other materials—sawdust, wood chips, leaf mulch, and cotton refuse—was negligible.

Experiments aimed at more precisely

determining the rates of monuron tolerated by citrus are continuing. In these tests a series of high dosages is applied to the root zones of trees to determine the amount required to produce symptoms of injury. Test trees at Riverside have been treated for three successive years at rates up to 20 pounds per acre. In these experiments the soil beneath Valencia orange and grapefruit trees was treated originally in November 1953 and re-treated in 1954 and 1955. Thus, at the 20-pound annual rate, the total application has amounted to 60 pounds per acre.

These treatments have caused no evidence of tree injury although single applications at the rate of 40 pounds per acre in the same orchard caused severe chlorosis and leaf drop.

In field tests, orange trees were injured by applications made during the first year after transplanting at rates as low as six pounds per acre. Tests on year-old seedlings of nine rootstock varieties grown in gallon cans verify that young citrus is injured by rates in the range of five to ten pounds per acre.

Additional tests have been made of foliage sprays of monuron to determine the susceptibility of trees to injury by the accidental application of monuron to skirt foliage. In previous tests, drenching sprays containing five pounds of monuron formulation per 100 gallons failed to produce foliage injury. When this type of experiment was repeated in November 1955, the foliage sprays

caused a burning of unhardened young leaves while mature leaves were not affected. Injured leaves soon dropped but were replaced by normal foliage. There was no evidence of systemic injury to the trees.

Five field-scale tests of noncultivation in lemon orchards were begun in the coastal areas during the autumn of 1955. Excellent weed control was obtained by autumn and spring applications of two pounds per acre except in one case where rain did not occur for extended periods after application. No apparent injury to the trees has resulted. Tolerance tests on mature lemon trees were made with high rates of monuron in three locations, two in Santa Barbara County and one near Fallbrook.

In Santa Barbara County, rates up to 18 pounds per acre in one test and up to 42 pounds per acre in the other test failed to produce symptoms of injury during the winter and spring months following treatments applied in early November 1955. Removal of the orchards terminated the experiments in May 1956.

The trees near Fallbrook treated in November 1955, at 10, 15, and 20 pounds per acre, showed no symptoms of injury in September 1956. These tests provide evidence that lemons in addition to oranges and grapefruit are relatively tolerant of applications of monuron.

## Fruit Analyses

Fruit from a number of experimental plots has been analyzed for monuron residue. Samples were taken for analysis immediately after treatment and at monthly intervals for three months. Valencias, navels, and Eureka lemons were included in the studies. Only trace quantities of the herbicide were found.

Based on these studies, the federal residue tolerance for monuron in market fruit was established at 1 ppm and applies to all species and varieties of citrus fruits.

However, monuron is registered for use with navel oranges, Valencia oranges, and lemons only with use restricted to certain districts of California. The desert areas are among those excluded from the registration.

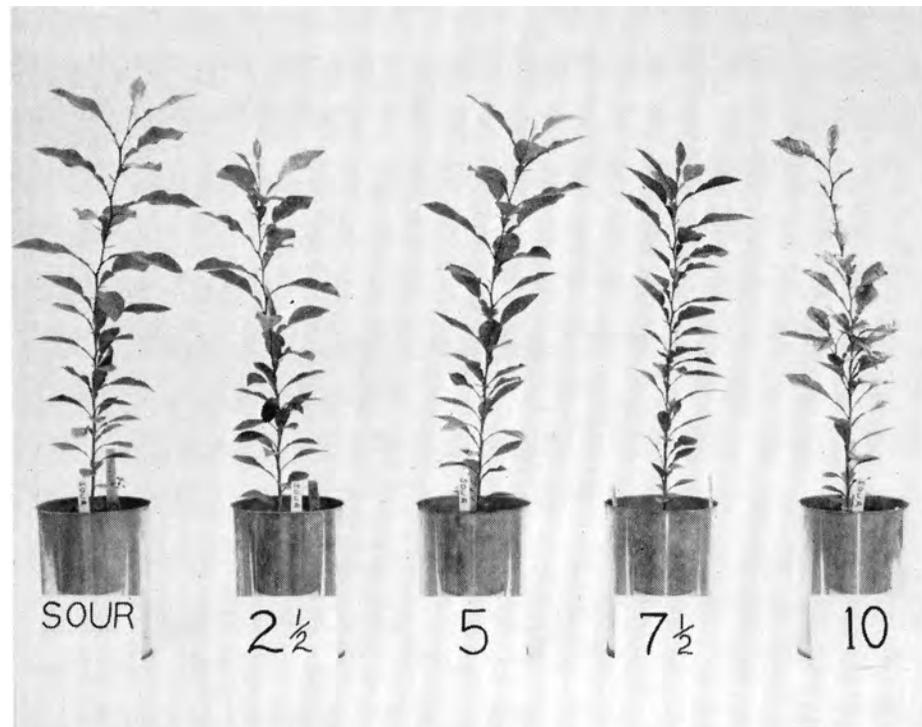
Use limitations are subject to change from time to time. The latest information on this aspect of the use of monuron is available through local regulatory officials and agricultural chemical trade channels.

*B. E. Day is Assistant Plant Physiologist, University of California, Riverside.*

*R. C. Russell is Principal Laboratory Technician, University of California, Riverside.*

*C. D. McCarty is Extension Field Technologist, University of California, Riverside.*

*The above progress report is based on Research Project No. 1475.*



**Sour orange rootstock appears to be more resistant to monuron than rough lemon. Slight chlorosis was evident at the seven and one half pound per acre rate. Partial leaf drop occurred at 10-pound rate.**