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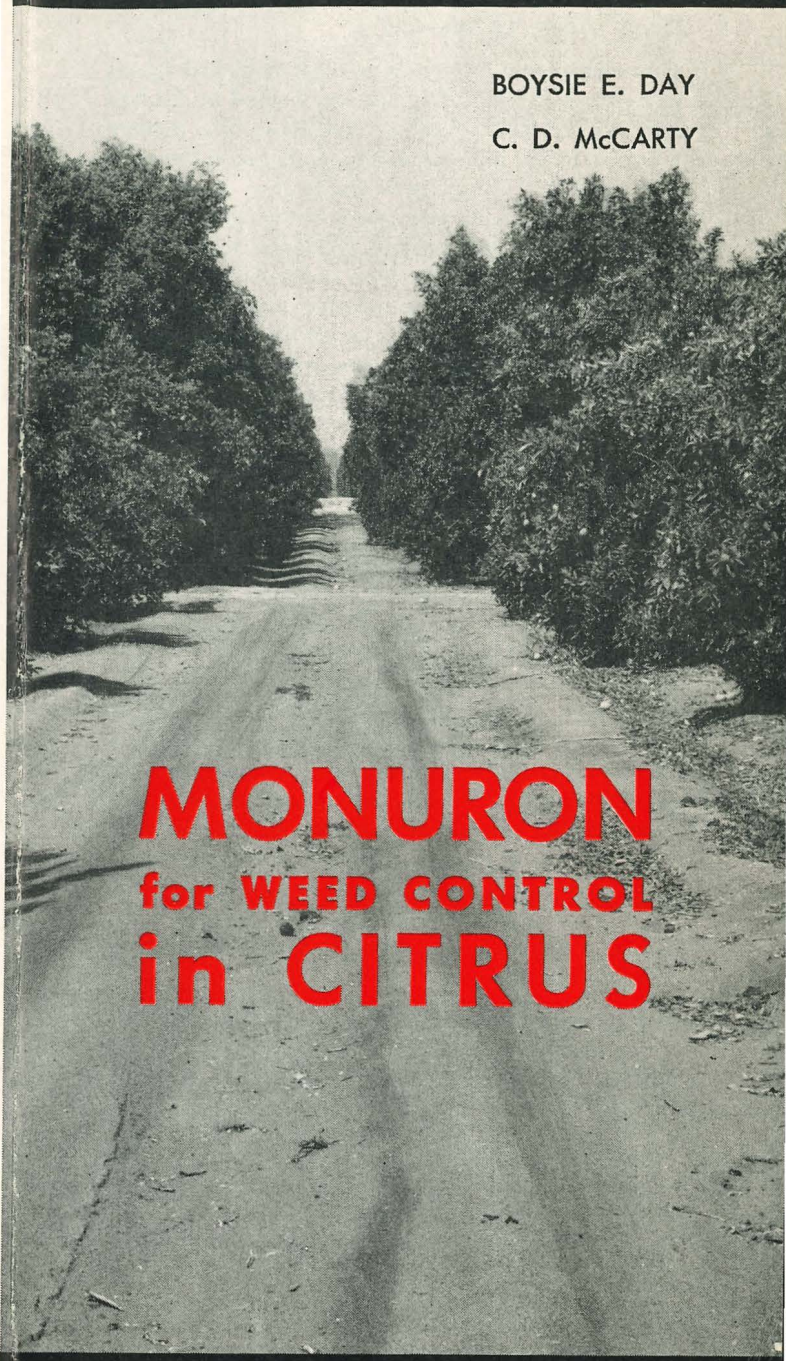

# MONURON for WEED CONTROL in CITRUS

CALIFORNIA AGRICULTURAL
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is increasing as a cultural practice in California citrus orchards. Two types of noncultivation programs have evolved. The first allows development of a permanent weed sod which is controlled by mowing. The second method involves the complete eradication of weeds by means of oil or chemical sprays. Since weeds compete with the trees for water and fertilizer, these materials are saved when weeds are eliminated. Also, a noncultivation program improves the tilth of the soil, thereby improving water penetration and conditions for root growth.

In the past, repeated oil sprays have been used to control major weed growth. These sprays must be applied frequently when a nontillage program is being started, and usually cost more than conventional tillage methods. As the weed seed population of the soil surface is reduced, costs fall below those of other methods of weed control. Conversion to nontillage, therefore, amounts to an investment from which returns are received only after a period of years.

Recent developments in the field of chemical weed control indicate that, in mature orchards, the soil may be selectively sterilized with monuron (3-(p-chlorophenyl)-1,1-dimethylurea) to prevent the growth of weed seedlings. Control by this method can, in most cases, greatly reduce the initial cost of converting to a nontillage program.

# CAUTION

**Legal limitations pertaining to the use of monuron in local areas are subject to change. Information concerning these limitations is available from local regulatory officials and through agricultural chemical trade channels. Restrictions will also be found on the manufacturer's label.**

**Young seedlings are sensitive to monuron; mature trees are relatively resistant. Therefore, monuron is recommended for use only in mature orchards.**

**At high dosages, monuron can injure citrus trees. Handle it with caution, and apply strictly according to instructions. Even small amounts spilled on the soil can sterilize it to plant growth for several years.**

**While no adverse effects have been observed on citrus treated with monuron at low rates, it should be noted that this is a new material, and the long-term effects which may result are unknown.**

# MONURON . . . what it will or will not do . . . how, when, and where to use it effectively

## WHAT IS MONURON?

Monuron is a wettable powder and, for all practical purposes, is insoluble in oil and water. Essentially, it is nontoxic to warm-blooded animals, noncorrosive to spray equipment, nonvolatile and stable in storage.

At rates of 2 pounds of commercial formulation (80 per cent active ingredient) per acre of actual soil area treated, it is toxic to weed seedlings for periods ranging from two to eight months, depending on soil type, temperature, and amount of rainfall.

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

## HOW DOES IT WORK?

Monuron acts as an herbicide when picked up by plant roots. To be fully effective, it must be leached into the soil by rainfall or irrigation. The amount required to kill is lowest when plants are in the seedling stage, and increases as plants grow older. Monuron is not toxic to weed seeds before germination. Seedling plants will emerge from soil treated with monuron, but will die as soon as their roots pick up the herbicide. Many plant species tolerate relatively high dosages when mature, yet are highly susceptible as seedlings. This is the case with citrus. Young orange seedlings are sensitive; mature trees are relatively resistant. Therefore, monuron is recommended for use only in mature orchards.

## WHAT WEEDS DOES IT KILL?

Only seedling weeds are killed by monuron at rates which can be used with safety in citrus orchards. Most mature weeds are not affected. Established perennial grasses, such as Bermudagrass and Johnsongrass, will thrive in a monuron-treated orchard because of no competition from other weeds. However, most annual grasses are easily killed, as are chickweed and nettle. Although monuron is most effective when absorbed by roots, these more sensitive plants may absorb lethal amounts through their foliage. Two pounds of monuron per acre control chickweed in any stage of growth. Annual nettle up to a foot tall is killed by spray treatments. Two pounds will control annual bluegrass up to 6 inches tall, and wild oats and foxtail when treated before tillering or stooling.

## WHAT WEEDS DEVELOP RESISTANCE?

Some weed seedlings become resistant to monuron very soon after germination. One species, turkey mullein, is resistant even in the early seedling stage. Spotted spurge and other prostrate species of spurge are also resistant. Puncture vine and common mallow develop resistance to monuron soon after germination. Resistant species are the first to come back into orchards following monuron treatment, as the effectiveness of the chemical gradually decreases.

## HOW MUCH TO APPLY

The amount of monuron needed to prevent the establishment of weeds depends upon the weed species present and the amount of clays and organic matter in the soil. Heavy applications of organic matter in the form of manure and mulches reduce the effectiveness of monuron and must be compensated for by higher rates.

When monuron is leached into the soil, a certain percentage is adsorbed on the soil particles. The adsorbed material becomes unavailable to the roots. Plant roots are capable of absorbing only the monuron that remains dissolved in the soil solution. Heavy soils and soils high in organic matter adsorb more monuron than do light or sandy soils, and therefore require higher dosages for effective weed control. In lighter soils the dosage rate may be reduced.

The variation in dosage requirements does not follow soil classifications as expressed by available soil surveys. For reasons of economy and tree safety, it is desirable to apply the lowest possible amount in the fall that will provide adequate weed control for the winter, and in the spring to provide for the summer season. Under most conditions, an average rate of 2 pounds per acre will accomplish this. In some cases, however, the amount will have to be increased; in others it is more than adequate. It is suggested that a 2-pound-per-acre rate be tried initially in an orchard. As later treatments become necessary, the amount applied may be adjusted upward or downward by ½ to 1 pound to give the rate needed for effective control. The factors governing dosage requirements to kill weeds also govern the tolerance level of citrus. If the amount required for weed control is higher, the amount tolerated by citrus is correspondingly higher.

The practical effectiveness of monuron herbicide for control of seedling weeds in citrus orchards has been established. It must be remembered, however, that a weed control program of this type is based on the capability of citrus to tolerate low rates of monuron. **Exceeding these rates, even in local spots, can result in injury.** A weed control program of this nature must be carried out with precision and care.

## WHEN TO APPLY

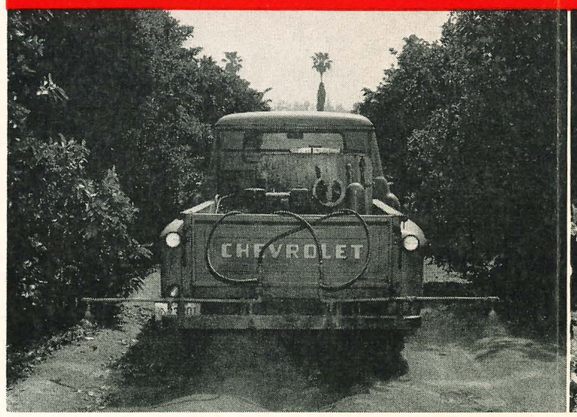
Under sprinkler irrigation, monuron may be applied at any time during the year. If furrow irrigation is used, apply in the fall just before the rainy season so that monuron will be leached into the soil. Under most conditions, this provides weed control throughout the winter months.

Monuron is broken down by action of the ultraviolet rays of sunlight if the chemical lies exposed on the soil surface for long periods of time. Once monuron has been leached into the soil, light is no longer a factor. Although such decomposition occurs so slowly that it is not normally a major consideration, fall applications should be made as close to the rainy season as practical in order to minimize this possibility.

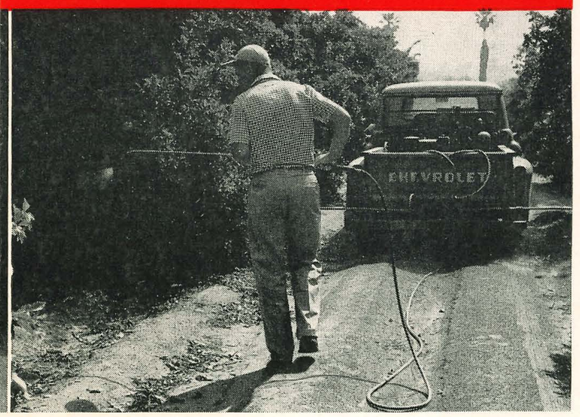
Monuron may be applied again in the spring just before the end of the rainy season. In some cases, where control is holding up well, only the furrows need be treated at this time since weed control first breaks down in the furrows where conditions are more favorable for leaching and bacterial action.

For best results, apply monuron to bare ground before the germination of weed seeds. Monuron is adsorbed in the upper soil layer. Cultivation or other disturbances of the soil following application may destroy or greatly reduce monuron's effect.

A fixed boom is the most practical spray method for applying monuron. Avoid cross spraying because it doubles the rate of application in the overlap area.




Spray between trees with a hand gun. Avoid overdosage. One pass over area is sufficient, with operator moving at same rate as the rig.




## HOW TO APPLY

Weigh carefully the amount of monuron going into the spray tank. Volume measurements of the powder, and other approximate methods are not sufficiently accurate. Add monuron to the tank after it has been partially filled with water and while the agitator is in motion. Continuous agitation is necessary to keep the material in suspension. Mechanical agitation is preferred since air agitation may produce excessive foaming and part of the monuron may be trapped in the foam. If agitation is stopped, make sure the herbicide is resuspended before continuing spraying. This may be checked by probing the tank, especially the corners.

Spray rigs equipped with piston or centrifugal pumps are best. Gear pumps are satisfactory, but tend to wear excessively with wettable powders. Use hoses and booms with small diameters to keep the velocity high and prevent "settling out" of monuron inside the hose or boom. Screens and strainers should be at least 50-mesh to prevent clogging.

The pressure at which the rig is operated should be accurately controlled, and the speed of movement through the orchard must be kept constant in order to obtain uniform coverage. Take care to prevent local overdosing as a result of double passes over the same row, momentary slowing of the rig, and turning at the ends of the rows. Always turn off the boom before the rig is brought to a stop. Following use, clean spray equipment with several rinses of water.

A fixed boom is the most practical method of spraying. The area between the trees may be sprayed with a hand gun. Avoid cross spraying with a boom rig since this doubles the rate in the overlap area.

There is danger of overdosage in spraying with a hand gun. One pass over the area with the hand gun is sufficient, moving it at the same rate at which the rig moves through the orchard.

Nozzles giving a "flat fan" pattern of distribution are best. Set them so that there is a slight overlap at ground level. This compensates for the thinning effect at the edges of the fans. Do not overlap fans so much that partial double coverage occurs.

Moderate drift within the orchard or wetting of tree skirts does not cause serious damage.

## CALIBRATION METHOD

It is usually unnecessary to spray under the skirts of citrus trees. Rates of application should be based on the actual area of soil covered and not on total acreage of citrus.

A simple method of calibrating a spray rig for accurate application of an herbicide is to determine the amount of carrier (in this case water) needed to cover a known area and then calculate the amount of herbicide to be added. This can be done in the following manner.

1. Measure a known distance over which to run the rig. Multiply this distance by the width of the boom swath. This will give the area covered.

2. Fill the spray tank with a known amount of water. Drive the spray rig over the measured distance, *operating it at the same speed and pressure at which the spraying is to be done in the orchard.*

3. Measure the amount of water left in the tank and, by subtraction, find out how much water was applied over the measured area.

4. From this figure, calculate gallons per acre applied and the amount of herbicide to be added.

Example:

(a) Width of boom swath = 10 feet
Measured distance = 1,000 feet
10 x 1,000 = 10,000 square feet area covered

$$\frac{10{,}000}{43{,}560 \text{ (No. of sq. ft. in an acre)}} = 0.23 \text{ acres}$$

(b) If it is found that 10 gallons of water were used in the calibration run, then

$$\frac{10 \text{ gallons}}{0.23 \text{ acres}} = 43.4 \text{ gallons of water will be applied per acre.}$$

(c) If a 2-pound-per-acre rate is required, 2 pounds of herbicide should be added for every 43.4 gallons of water in the spray tank. If the tank holds 100 gallons, the amount of herbicide to be added may be calculated as follows:

$$\frac{2 \text{ lbs/A}}{43.4 \text{ gals/A}} : \frac{X}{100 \text{ (capacity of spray tank)}}$$

$$X = \frac{2 \times 100}{43.4} = 4.6 \text{ pounds of herbicide to be added to 100 gallons}$$

To determine the amount of water used in spraying, it is often convenient to calibrate a stick with notches on it at 5-gallon intervals. This can be done by adding 5 gallons of water at a time to the tank and marking each level on the stick. Use of a measuring stick of this type allows the operator to measure accurately the amount of water in the spray tank.

For accurate application, it is important that the rig operate at the same pressure and travel at the same speed at which the trial run was made.

All nozzles on the boom must deliver the same amount of liquid. Check each nozzle by measuring the amount of spray delivered in 30 seconds. Replace those nozzles which deliver excess material. (Nozzles tend to wear with the use of wettable powders, and as they wear they deliver a larger volume.)

The amount of water used per acre is not important so long as adequate coverage is maintained. **The point to remember is to apply a given rate over a given area.**

To change the gallonage per acre, use one of the following methods:

To decrease gallonage per acre:
- Increase speed.
- *or*
- Lower the pressure.
- *or*
- Use smaller nozzles.

To increase gallonage per acre:
- Decrease speed.
- *or*
- Increase the pressure.
- *or*
- Use larger nozzles.

# REMEMBER . . .

**Established weeds are not controlled by monuron.**

**Continuous agitation in the spray rig is necessary. If agitation is stopped, be absolutely sure that the herbicide is resuspended before continuing spraying. Check by probing bottom of the tank.**

**Avoid overdosing by spilling, overlapping, slowing, turning, and stopping.**

**Do not disturb soil after application of monuron.**

**Do not apply near other crops or where runoff water from the grove comes in contact with roots of other crops or ornamentals.**

**Avoid spray drift to other crops.**

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