

# A Guide To Chemical Weed Control In Tropical And Subtropical Fruit And Nut Crops In Hawaii

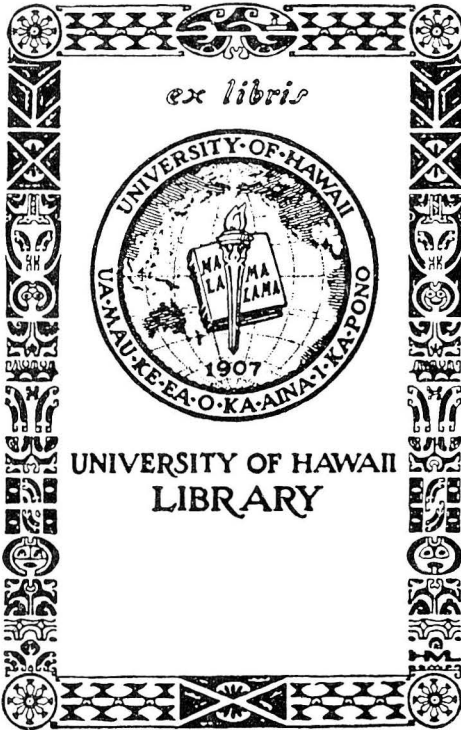
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**A GUIDE TO CHEMICAL WEED CONTROL  
IN TROPICAL AND SUBTROPICAL FRUIT AND NUT CROPS IN HAWAII**

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The use of herbicide, chemicals for killing weeds, is an accepted cultural practice in the fruit and nut agricultural industry of Hawaii. Herbicides are safe when used according to local recommendations as well as the directions on the manufacturer's label. They are indispensable to the agricultural industry. They are essential for continued efficient crop yields to offset increasing labor and other production costs. They are an effective and economic tool necessary to help control weeds under present day conditions.

Ecologically, Hawaii is unique compared to the mainland United States. In the islands the climate, soils, and vegetation are subtropical and tropical in nature. As a result, herbicide recommendations approved for temperate areas do not always apply to Hawaii; hence, herbicides must be field-tested before being recommended for use under Hawaiian conditions.

All of the chemicals listed in this circular have been approved for use and are registered with the Federal Food and Drug Administration. Although the Department of Horticulture, College of Tropical Agriculture, has field tested many of the herbicides, the chemicals are being recommended on a trial-use basis before widespread field applications are made. This is necessary because the effectiveness of a herbicide may vary in the islands depending on specific soil and climatic conditions and weed species.

**GENERAL SUGGESTIONS**

1. Read the label on the container of the herbicide. Know the precautions to take and the limitations of the herbicide.

2. Weeds are easiest to kill when they are small.
3. Use low-pressure sprayers (25 pounds) with a flat-fan, spray-type nozzle.
4. Clean spraying equipment thoroughly after each use.
5. Do not spray in windy weather.
6. A herbicide usually does not control all weeds and it may be necessary to mix two chemicals together or to alternate the chemicals used.
7. Consult your county Extension agent if you need advice.

#### SPRAYER CALIBRATION

1. Fill sprayer with water only.
2. Spray a measured area at a comfortable speed at a fixed pressure.
3. Measure the amount of water required to refill the tank.
4. Calculate the amount of water needed for one acre. To do this, multiply the amount of water used in the measured area with the number of times the measured area (in square feet) is divided into 43,560 square feet. Usually 30 to 40 gallons per acre are used for pre-emergence applications of herbicides and 60 to 100 gallons per acre for post-emergence applications.
5. Mix the amount of required active material per acre with the number of gallons of water the sprayer uses per acre.

#### HERBICIDES AND THEIR PROPERTIES

##### ATRAZINE 2-CHLORO-4-ETHYLAMINO-

##### 6-ISOPROPYLAMINO-S-TRIAZINE

Primarily absorbed by the roots; some leaf absorption by broadleaved weeds.

Very low toxicity to warm-blooded animals.

Soil moisture needed for proper action.

##### DALAPON (DOWPON) 2,2-DICHLOROPROPIONIC ACID

Selective for grasses; leaf absorption very effective.

Very low toxicity to warm-blooded animals.

##### DICHLOBENIL (CASORON) 2,6-DICHLOROBENZONITRILE

Root-absorbed, soil sterilant type, soil incorporation enhances activity.

Very low toxicity to warm blooded animals.

Soil moisture needed for proper action.

##### DIURON (KARMEX) 3-(3,4-DICHLOROPHENYL)-1, 1-DIMETHYLUREA

Root-absorbed, soil sterilant type, resists leaching; absorption through leaves enhanced with surfactant.

Very low toxicity to warm-blooded animals but may irritate skin and eyes.

Soil moisture needed for proper action.

*MONURON (TELVAR) 3-(P-CHLOROPHENYL)-1,1-DIMETHYLUREA*

Root-absorbed, soil sterilant type.

Used selectively in some crops such as pineapple sugarcane, citrus, and avocado for seedling weeds on medium to heavy soils.

Very low toxicity to warm-blooded animals but may cause irritation to skin, eyes and nose.

Moisture needed for proper action.

*PARAQUAT 1,1'-DIMETHYL-4,4'-BIPYRIDYLIUM SALT*

*OF DIMETHYLSULFATE*

Non-selective, leaf-absorbed, inactivated on contact with soil.

Moderately toxic to warm-blooded animals but skin irritations may develop on prolong contact.

Optimum efficiency obtained when applied in subdued light.

*PENTACHLOROPHENOL (PCP)*

Non-selective, leaf absorbed contact type.

High toxicity to warm-blooded animals, absorbed through skin.

Irritating to skin, nose and eyes; insoluble in water; available as formulated product.

Primarily used as a fortifying agent for oils.

*PETROLEUM SOLVENTS*

Non-selective, leaf absorbed contact type.

Non-toxic to warm blooded animals.

*SIMAZINE (2-CHLORO-4,6-BIS(ETHYLAMINO)-S-TRIAZINE*

Root-absorbed, soil sterilant type at high rates.

Very low toxicity to warm-blooded animals.

Soil moisture needed for proper action.



GUIDE FOR TRIAL USE OF HERBICIDES WITH FRUIT CROPS

FRUIT/CHEMICAL	MAXIMUM DOSAGE AND/OR <sup>3</sup> RATE OF COMMERCIAL FORMULATION/ACRE	METHOD AND TIME OF APPLICATION AND COMMENTS
<b>AVACADO</b>		
Dichlobenil <sup>1</sup> (Casoron W-50)	4-6 lbs. a.i. 8-12 lbs.	Apply as directed spray before the weeds emerge above the soil surface. Follow with 1/2- to 1-inch irrigation. If possible, soil-incorporate at 1- to 2-inch depth.
Paraquat plus surfactant <sup>2</sup>	1/2-1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks may cause injury. Use on non-bearing trees only.
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when necessary. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
Petroleum solvents	40-100 gals.	Apply as directed spray to small weeds on an as-needed basis.
Monuron <sup>1</sup> (Telvar)	3 1/4 lbs. a.i. 4 lbs.	Apply once a year under well-established trees before weeds emerge above the soil surface.
Simazine <sup>1</sup> (Simazine 80-W)	2-4 lbs. a.i. 2 1/2 - 5 lbs.	Apply as directed spray before weeds emerge above the soil surface.

FRUIT/CHEMICAL	MAXIMUM DOSAGE AND/OR <sup>3</sup> RATE OF COMMERCIAL FORMULATION/ACRE*	METHOD AND TIME OF APPLICATION AND COMMENTS
<b>BANANA</b>		
Dalapon (Dowpon)	4 1/4 - 8 1/2 lbs. a.i. 5-10 lbs.	Apply before grass heading stage in 80 to 100 gallons of spray mix per acre. Do not apply more than 26 pounds per acre per year. Use spray solution within 24 hours after mixing for maximum effect.
Diuron (Karmex)	2-4 lbs. a.i. 2 1/2 - 5 lbs.	Apply only after the plants are established and keep away from the base or basin of newly set plants. Treat cautiously on loose or lighter soils. Apply as a basal spray either as a pre-emergence treatment (no surfactant) in 40 gallons of spray mix per acre or as a post-emergence spray on emerged weeds (with surfactant) <sup>2</sup> in 80 to 100 gallons of spray mix per acre. Do not apply more than 12 pounds of Karmex per year. Do not plant other crops in the area for 2 years after last treatment.
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Use on non-bearing trees only.
Petroleum solvents	40-100 gals./acre	Apply as directed spray to small weeds on an as-needed basis.
<b>CITRUS</b>		
Dalapon <sup>1</sup> (Dowpon)	1 1/4 - 3 lbs. a.i. 1 1/2 - 3 1/2 lbs.	Apply 1 1/2 pounds at 2- to 4-day intervals for a series of three applications after grass starts to regrow. Do not apply in groves younger than 4 years, and use only one series of applications per year. Use with extreme caution on island soils. Add non-ionic wetting agent.
Diuron <sup>1</sup> (Karmex)	1 1/2 - 4 lbs. a.i. 2-5 lbs.	Apply only once a year to a weed-free soil in established orchards. A surfactant <sup>2</sup> may be used if small weeds are present. Do not spray on loose soil in the planting basin.



FRUIT/CHEMICAL	MAXIMUM DOSAGE AND/OR <sup>3</sup> RATE OF COMMERCIAL FORMULATION/ACRE	METHOD AND TIME OF APPLICATION AND COMMENTS
Monuron <sup>1</sup> (Telvar)	3 1/4 lbs. a.i. 4 lbs.	Apply once a year under well-established trees.
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks may cause injury. Use on non-bearing trees only.
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when weeds reappear. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
Petroleum solvents	40-80 gals.	Apply as directed spray to small weeds on an as-needed basis.
Simazine <sup>1</sup> (Simazine 80-W)	2 lbs. a.i. 2 1/2 lbs.	Do not apply in groves less than one year old or in nurseries.
<b>COFFEE</b>		
Dalapon (Dowpon)	7 1/4 lbs. a.i. 8 1/2 lbs.	Apply to grass as a directed spray. Repeat application in 4 to 6 weeks. Do not apply more than twice a year.
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks may cause injury. Use on non-bearing trees only.
Pentachlorophenol <sup>4</sup> (PCP)	4 1/2 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent.

FRUIT/CHEMICAL	MAXIMUM DOSAGE AND/OR <sup>3</sup> RATE OF COMMERCIAL FORMULATION/ACRE	METHOD AND TIME OF APPLICATION AND COMMENTS
Petroleum solvents	40-100 gals.	Apply as directed spray to small weeds on an as-needed basis.
<b>GUAVA</b>		
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks may cause injury. Use on non-bearing trees only.
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when weeds reappear. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
Petroleum solvents	40-100 gals.	Apply as directed spray to small weeds on an as-needed basis.
<b>MACADAMIA NUTS</b>		
Atrazine (Atrazine 80-W)	2-4 lbs. a.i. 2 1/2-5 lbs.	Apply just prior to weed emergence before harvest. Repeat applications as necessary after gathering nuts. Do not spray on loose soil in plant basin. Do not exceed 10 pounds per acre per year.
Dalapon (Dowpon)	4 1/4-8 1/2 lbs. a.i. 5-10 lbs.	Apply before grass heading stage. Do not apply during harvesting season unless nuts have been picked up. Do not apply more than 20 pounds of Dowpon per acre per year. Use caution on loose soils.
Diuron (Karmex)	2-4 lbs. a.i. 2 1/2 - 5 lbs.	Use only low rate on new plantings. Do not apply on loose soil in plant basin. Apply as a directed basal spray either as a pre-emergence treatment (no surfactant) in 40 gallons of spray mix per acre or as a post-emergence spray on emerged weeds (with surfactant <sup>2</sup> ) in 80 to 100 gallons of spray mix per acre. Spray cautiously and use lower rates on <u>aa (rock) soils</u> . Do not apply more than <u>10 pounds</u> of Karmex per year.

FRUIT/CHEMICAL	MAXIMUM DOSAGE AND/OR <sup>3</sup> RATE OF COMMERCIAL FORMULATION/ACRE	METHOD AND TIME OF APPLICATION AND COMMENTS
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks may cause injury. Use on non-bearing trees only.
Simazine (Simazine 80-W)	2-4 lbs. a.i. 2 1/2 - 5 lbs.	Apply just prior to weed emergence before harvest. Repeat applications as necessary after gathering nuts. Do not spray on loose soil in plant basin. Do not exceed 10 pounds per acre per year.
<b>MANGO</b>		
Dichlobenil <sup>1</sup> (Casoron W-50)	4-6 lbs. a.i. 8-12 lbs.	Apply as a directed spray before the weeds emerge above the soil surface.
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mixture per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks may cause injury. Use on non-bearing trees only.
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when necessary. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
Petroleum solvents	40-100 gals.	Apply as directed spray to small weeds on an as-needed basis.
<b>PAPAYA AND PASSION FRUIT</b>		
Paraquat plus surfactant <sup>2</sup>	1/2 - 1 lb. a.i. 1-2 qts.	Apply as a directed spray to emerged weeds in 80 to 100 gallons of spray mix per acre. Add a non-ionic surfactant. Spray contact on green succulent trunks or stems may cause injury. Use on non-bearing trees and vines only.

FRUIT/CHEMICAL	MAXIMUM DOSAGE AND/OR <sup>3</sup> RATE OF COMMERCIAL FORMULATION/ACRE	METHOD AND TIME OF APPLICATION AND COMMENTS
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when necessary. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
Petroleum solvents	40-100 gals.	Apply as directed spray to small weeds on an as-needed basis.
<b>PERSIMMONS</b>		
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when necessary. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
<b>PLUMS</b>		
Dalapon (Dowpon)	4 1/4 - 8 1/2 lbs. a.i. 5-10 lbs.	Spray area within 3 feet radius of tree. Do not apply more than twice in any one season. Do not graze livestock in treated area.
Pentachlorophenol <sup>4</sup> (PCP)	10 lbs. a.i.	Apply as directed spray to emerged weeds in oil-water emulsion. Repeat application when necessary. Use caution around young plants. Follow directions of preparation <sup>4</sup> or contact your county Extension agent. <u>Do not apply after fruits start to form.</u>
Petroleum solvents	100 gals.	Apply as directed spray to weeds as needed.
Simazine <sup>1</sup> (Simazine 80-W)	2-4 lbs. a.i. 2 1/2 - 5 lbs.	Apply as directed spray before weeds emerge above soil surface. Apply on trees after trees have been established one year or more.

- 1) Note: Suggestions based on recommendations from Mainland U.S. Agricultural Experiment Stations.
- 2) Surfactants are substances that reduce the inter-facial tension of two boundary lines. These materials can be classified as non-ionic, anionic and cationic. Most surfactants are non-ionic for they do not ionize. Examples are X-77 and Tergitol NPX. Wetting agents and detergents are primarily anionic for they become ionized in solution and the negative part of the molecule exerts the primary influence. Cationic forms also become ionized in solution but are not generally used. The positive portions of the molecule is dominant when these materials are ionized.
- 3) a.i. = pounds (lbs.) of active ingredient per acre.
- 4) Preparation of PCP-Aromatic Oil Emulsion.

PCP solutions in aromatic oils can be purchased. Most factory prepared solutions contain an emulsifier incorporated in the solution. Hence all that is necessary is to add the PCP solution into water and stir.

"Home-made" solutions are made by dissolving one pound of PCP per gallon of heated aromatic oil. The common practice is to add 50 pounds of PCP in 50 gallons of aromatic oil contained in a 55 gallon steel drum placed over a crude wood burning stove. The contents of the drum are heated to about 140°F (60°C). The contents of the drum are stirred periodically until the PCP cannot be felt by the stirring rod (pole).

The solution is then allowed to cool before using. The solution is stable under ordinary temperatures.

The herbicide is made by adding 8 to 22 gallons of the PCP solution into 100 gallons of water containing a suitable emulsifier and stirred.

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6. Thomson, W. T. Agricultural Chemicals; Book II, Herbicides. 1964. The Simmons Publishing Co., Davis, California.
7. USDA Summary of Registered Agricultural Pesticide Chemical Uses. 1967.

## EMERGENCY TREATMENT FOR POISONING

- A. Call your personal physician at once.
- B. If your physician is not available, call the POISON CONTROL CENTER OF HAWAII, Telephone 513-511, at Kauaike-olani Children's Hospital.
  - 1. Describe poison by name. They can advise you how to manage the problem over the phone.
- C. In the meantime, remove the patient away from the poison.
  - 1. If the poison has been spilled on the skin or clothing, remove the clothing and wash the skin with lots of water.
  - 2. If the poison has been inhaled, remove the patient to the open air; if the patient is not breathing, artificial respiration must be administered (mouth-to-mouth method).
  - 3. If the poison has been swallowed, attempt to empty the stomach immediately.
    - a. Induce vomiting by giving large amounts of warm, strong salt water and attempt to gag patient in order to produce vomiting by putting finger or tongue depressor down patient's throat.
    - b. If the poison is in petroleum solvents, do not induce vomiting unless directed by physician.
    - c. DO NOT INDUCE VOMITING IN AN UNCONSCIOUS PATIENT.
- D. If you cannot contact your physician or the Poison Control Center, after performing the above first-aid measures, deliver the patient to the nearest Emergency Treatment Facility in a hospital for further care. Specific antidotes and treatment vary with the poison involved--remember to take the poison with you to the physician so he can read the name and the contents of the poisonous compound involved.

*NOTE: The use of brand names and names of manufacturers in this publication is for convenience and does not imply endorsement of the products or the manufacturers by the College of Tropical Agriculture.*

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