

A GUIDE TO CHEMICAL WEED CONTROL IN VEGETABLE CROPS IN HAWAII

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Some herbicides recommended for use in horticultural crops on the mainland U. S. will not give the desired results under Hawaiian conditions because of our different climatic conditions, soil types, and weed populations. In some cases, severe crop injury makes the use of a recommended herbicide unwise, while in other cases the poor control of certain weeds makes its use unprofitable.

To aid the Hawaiian grower select and use the proper herbicide, the Hawaii Agricultural Experiment Station of the College of Tropical Agriculture has a continuing research project on chemical weed control. Under this project, conducted by the Department of Horticulture, chemicals are field-tested on several crops. The results of the field tests are available to growers on a trial-use basis in the form of this guide published by the Cooperative Extension Service. All chemicals are recommended for trial use only; all chemicals have been registered with the Federal Food and Drug Administration.

CAUTION TO GROWERS ON TRIAL USE

All herbicides suggested for use on crops should be put on a small-scale trial by each grower before a large-scale

field application is made. The weed control benefits obtained by one grower using a recommended herbicide may not mean the same benefits to another grower using the same herbicide on the same crop, especially if the soil type, climatic conditions, and the technique of application differ.

For best results, sprayers and granular applicators used to apply herbicides must be calibrated to deliver the exact amounts of chemical suggested over a given area. Failure to calibrate will usually result in an over-application of the herbicide and cause crop injury and crop contamination. It may also result in an under-dose, which gives poor or no weed control.

Growers should remember that at present there is no herbicide approved for use on vegetable crops that controls all types of weeds. A pre-emergence application of most vegetable herbicides will control weeds for only 4 to 6 weeks. It will not effectively control many large-seeded weeds, such as cocklebur, castor bean, and others. On dry soils, the application of 1/2 acre-inch of water (13,500 gallons per acre) immediately after treatment may greatly enhance the action of pre-emergence herbicides.

THE CHOICE OF HERBICIDE WHEN TWO OR MORE ARE SUGGESTED FOR TRIAL USE

When two or more herbicides are listed for trial use on a specific crop, choose the herbicide on the basis of the predominant weed species that needs to be controlled. This can be done by referring to Table 6, which shows how susceptible specific weeds are to specific herbicides. For example: In a tomato crop, if the predominant weeds are swinecress and bristly foxtail, Dymid or Enide gives good control; but if the predominant weeds are sandbur and purslane, Dacthal as a directed spray would be a better choice.

In some cases, mixing two chemicals may be desirable because of the weed species present. In mixing herbicides, take care to mix only those chemicals that are registered for use on the specific crop to be sprayed. When mixing, use the lower rates suggested and treat only a small plot to test the results of the mix. It is also better to rotate the use of chemicals, if possible, to prevent a build-up of tolerant weed species.

HOW TO CALIBRATE A KNAPSACK SPRAYER

STEP A. Determine total gallons of spray used per acre.

1. Measure off an area 2 x 50 feet (100 square feet).
2. Fill the sprayer with water to one-half capacity.
3. Determine the time it takes to spray the measured area at a comfortable walking speed and pumping pressure as used in the field. Repeat the procedure at least three times and find the average time.
4. Refill the sprayer to the original level with water and with about the same pressure and pumping speed, discharge the spray into a container at the average time determined above.

5. Measure the amount of water discharged into the container in a measuring cup and refer to Table 1 for gallons of spray used per acre. For example, Table 1 shows that when 11-3/4 fluid ounces are used to cover 100 square feet, the amount of spray used on 1 acre is equal to 40 gallons. Repeat steps (4) and (5) three times and take the average reading.

STEP B. Determine the amount of chemical to mix in a knapsack sprayer (4-gallon capacity). To do this, use the value for gallons of spray per acre found in Step A and refer to Table 2 for wettable powder formulations.

Table 1. Gallons of spray used per acre based on fluid ounces used per 100 square feet

<i>Amount of Spray Used to Cover 100 sq. ft.</i>	<i>Spray Used/Acre</i>
<i>Fluid Ounces</i>	<i>Gallons</i>
8-3/4	30
11-3/4	40
14-3/4	50
17-1/2	60
20-1/2	70
23-1/2	80
26-1/2	90
29-1/2	100

Table 2. Amounts of emulsifiable concentrate (liquid) to mix in 4 gallons of spray

Spray Used Per Acre	Quarts of Emulsifiable Concentrate Recommended Per Acre				
	2	4	6	8	10
<i>Gallons</i>	<i>Fluid Ounces to Mix in 4 Gallons</i>				
30	8-1/2	17	25-1/4	34-1/4	42-3/4
40	6-1/2	12-3/4	19-3/4	25-1/2	32
50	5	10-1/4	15-1/4	20-1/2	25-1/2
60	4-1/2	8-1/2	12-3/4	17	21-1/4
70	3-3/4	7-1/2	11	14-1/2	18-1/4
80	3-1/4	6-1/2	9-1/4	12-1/2	15-3/4
90	2-3/4	5-3/4	8-1/2	11-1/2	14-1/4
100	2-1/2	5	7-3/4	10-1/4	12-3/4

Conversion factors: 1 qt. = 32 fl. oz., 1 pt. = 16 fl. oz., 1/2 pt. = 8 fl. oz., 1/4 pt. = 4 fl. oz.

Table 3. Amounts of wettable powder to mix in 4 gallons of spray

Spray Used Per Acre	Pounds of Wettable Powder Recommended Per Acre				
	1	2-1/2	5	10	14
<i>Gallons</i>	<i>Ounces of Wettable Powder to Mix in 4 Gallons</i>				
30	2	5-1/4	10-1/2	21-1/4	29-3/4
40	1-1/2	4	8	16	22-1/2
50	1-1/4	3-1/4	6-1/2	12-3/4	18
60	1	2-1/2	5-1/4	10-1/2	15
70	1	2-1/4	4-1/2	9	12-3/4
80	3/4	2	4	8	11-1/4
90	3/4	1-3/4	3-1/2	7	10
100	1/2	1-1/2	3-1/4	6-1/2	9

Conversion factor: 16 oz. = 1 lb.

GRANULAR FORMS OF HERBICIDES

Granular forms of Vegadex 20%, Radox 20%, Alanap-3 10.8%, and other herbicides are commonly available. The main advantages of granular herbicides are that they are easy to apply after the crop emerges, and that they do little or no damage to the crop if applied while the crop foliage is dry, so the granules do not adhere to the plant parts. Granular herbicides are best applied to dry soils, followed immediately by applying water at 1/2 acre-inch (13,500 gallons per acre).

For amounts of granular herbicides to apply in areas less than 1 acre, refer to Table 4. Handy, small, hand-operated applicators, such as the PCB Spreader Model B manufactured by the Pacific Coast Borax Co. and the Ortho Whirlybird spreader, are well suited to small-scale use. Larger granular applicators, such as those manufactured by Gandy Co., John Deere Co., Ezee Flow Co., Noble Manufacturing Co., and Century Engineering Co., are available either from the mainland U. S. or through local representatives.

Table 4. Granular herbicide application rates for areas less than an acre

Recommended Per-acre Rates	Amounts to Apply in the Following Areas in Square Feet					
	500	1,000	5,000	10,890 (1/4 acre)	21,780 (1/2 acre)	
	Pounds	Ounces	Ounces	Ounces	Pounds	Pounds
	20	3-3/4	7-1/2	35	5	10
	28	5	10-1/4	50	7	14
	30	5-1/2	11-1/4	53	7-1/2	15
	37	6-3/4	13-1/2	67	9-1/4	18-1/2

DEFINITION OF TERMS USED

Pre-emergence spray--A spray applied to the soil after the seed is sown but before the crop and weeds emerge above the ground.

Broadcast treatment--Spraying or applying granules over an entire area, including plant rows and spaces between rows.

Pre-emergence directed spray--A spray applied to the soil before the weeds emerge, around transplanted crops, in such a manner as not to wet the crop plants.

Post-emergence directed spray--A spray applied to the weed growth around growing crops and in such a manner as not to wet the crop plants.

General contact spray--A spray used to kill the above-ground portions of all plant growth.

Preplant soil incorporation--A spray applied to well prepared soil ready for planting and disked or tilled into the soil before the crop is planted.

BETWEEN ROW WEEDING FOR WIDELY SPACED VEGETABLE CROPS

For vegetable crops that are planted in widely spaced rows, herbicides to control weeds may need to be applied between rows. Apply aromatic oils at the rate of 20 to 40 gallons per acre as a general contact spray when weeds are less than 2 inches high. Weeds will be controlled for 3 to 4 weeks; therefore, repeat applications will be necessary.

Caution: Direct spray carefully and avoid spraying plant parts. Do not spray during moderate to strong wind conditions. Plant parts contacted by spray will be severely injured and killed. Do not apply on root crops after seedling stage because of possible contamination from oily flavor. Do not use aromatic oils fortified with pentachlorophenol or sodium pentachlorophenate and other herbicides not cleared for use while the crop is growing.

METHYL BROMIDE SOIL FUMIGATION FOR WEED CONTROL WITH VEGETABLE CROPS

Methyl bromide soil fumigation at the rate of 1 pound per 100 square feet of land is most effective for controlling nutsedge and other weeds. For best results, the area to be treated should be thoroughly prepared for planting with no large clods left in the soil. The soil should also be slightly moist at the time of treatment. Release the methyl bromide gas under an airtight covering, usually of a polyethylene material. Leave the covering over the treated area for about 48 hours before removing it to start planting. The treated area should be free from weeds for an indefinite period if no weed seeds are either blown onto the area or introduced in the irrigation water.

Methyl bromide soil fumigation is used primarily for disinfecting soil in seedling beds and in seedling flats because the gas is relatively expensive, but several growers in the state are treating their entire field once every 2 to 3 years.

Methyl bromide controls not only weeds but also root knot nematodes. At the rate of 2 pounds per 100 square feet it controls some soil-borne pathogenic organisms. Methyl bromide soil fumigation is not recommended for soils to be planted immediately to onion or carnation, especially in the cool, higher elevations of the state, because of its toxic effects on these plants.

USE PESTICIDES WITH CAUTION

Be very careful in handling, storing, and using all herbicides and other chemicals. Store chemicals in a safe place away from children and animals. Avoid contamination of crops by following label directions and recommendations for careful and safe use.

Sinox PE and Premerge stain hands and clothing. Randox leaves a temporary burning sensation on body parts contacted. Paraquat skin contact and vapor inhalation can be hazardous.

Table 5. Active ingredients per gallon and per pound of herbicides

Trade Name	Common Name	Active Ingredients	Chemical Name
Alanap-3	naptalam, NPA (sodium salt)	2 lbs/gal	Sodium <u>N</u> -1 naphylphthalmate
Aatrex	atrazine	80% WP	2-chloro-4-(ethylamino)-6-(isopropylamino)- <u>s</u> -triazine
Balan	benefin	1.5 lbs/gal	<u>N</u> -butyl- <u>N</u> -ethyl- <u>a</u> , <u>a</u> , <u>a</u> , -trifluoro-2, 6-dinitro- <u>p</u> -toluidine
Caparol	prometryne	80% WP	2, 4-bis(isopropylamino)-6-(methylthio)- <u>s</u> -triazine
Chloro-IPC	chlorpropham, CIPC	4 lbs/gal	isopropyl <u>m</u> -chlorocarbanilate
Dacthal	DCPA	75% WP	dimethyl tetrachloroterephthalate
Dyanap	dinoseb DNBP (amine)	1 lb/gal	alkanolamine salts of 2- <u>sec</u> -butyl-4, 6-dinitrophenol
Ancrack	+		
	naptalam, NPA	2 lbs/gal	sodium <u>N</u> -1 naphylphthalamate
Dymid	diphenamid	80% WP	<u>N</u> , <u>N</u> -dimethyl-2, 2-diphenylacetamide
Enide	diphenamid	50% WP	<u>N</u> , <u>N</u> -dimethyl-2, 2-diphenylacetamide
Eptam	EPTC	6 lbs/gal	<u>S</u> -ethyl dipropylthiocarbamate
Lorox	linuron	50% WP	3-(3, 4-dichlorophenyl)-1-methoxy-1-methylurea
Paraquat CL	paraquat	2 lbs/gal	1, 1'-dimethyl-4, 4'-dipyridinium ion
Petroleum solvents	petroleum solvents	100%	
Premerge	dinoseb, DNBP (amine)	3 lbs/gal	alkanolamine salts of 2- <u>sec</u> -butyl-4, 6-dinitrophenol
Ramrod	propachlor	65% WP	2-chloro- <u>N</u> -isopropylacetanilide
Randox	CDA	4 lbs/gal	<u>N</u> , <u>N</u> -diallyl-2-chloroacetamide
Sinox PE	dinoseb, DNBP (amine)	3 lbs/gal	alkanolamine salts of 2- <u>sec</u> -butyl-4, 6-dinitrophenol
Sutan	butylate	6 lbs/gal	<u>S</u> -ethyl diisobutylthiocarbamate
Tillam	pebulate, PEBC	6 lbs/gal	<u>S</u> -propyl butylethylthiocarbamate
TOK E-25	nitrofen	2 lbs/gal	2, 4-dichlorophenyl-4-nitrophenyl ether
Treflan	trifluralin	4 lbs/gal	<u>a</u> , <u>a</u> , <u>a</u> , -trifluoro-2, 6-dinitro- <u>N</u> , <u>N</u> -dipropyl- <u>p</u> -toluidine
Vegadex	CDEC	4 lbs/gal	2-chloroallyl diethyldithiocarbamate

Table 6. Weed susceptibility to vegetable herbicides at suggested time and rates of application

+ = Good control; 0 = Fair control; - = Poor control; ? = Insufficient information on control

Weeds	Alanap-3	Atrazine	Chloro-IPC	Dacthal	Dymid or Enide	Eptam	Lorox	Premerge or Sinox PE	Ramrod	Radox	Tillam	TOK E-25	Treflan	Vegadex	Benefin	Caparol	Sutan
GRASSES																	
crabgrass (<u>Digitaria</u> spp.)	+	+	+	+	+	+	+	0	+	0	+	+	+	0	0	+	+
foxtail, bristly (<u>Setaria verticillata</u>)	+	0	+	+	+	+	+	0	+	+	+	+	+	+	+	+	+
nutgrass, purple (<u>Cyperus rotundus</u>)	-	-	-	-	-	+	-	-	-	-	0	-	-	-	-	-	+
sandbur (<u>Cenchrus echinatus</u>)	0	+	0	+	0	+	?	0	+	0	+	+	+	0	0	0	?
wiregrass (<u>Eleusine indica</u>)	0	+	0	0	0	+	+	0	+	0	+	0	+	0	+	+	+
BROADLEAVES																	
amaranth (<u>Amaranthus</u> spp.)	+	+	0	+	+	0	+	+	+	0	0	+	+	+	0	+	0
apple of Peru (<u>Nicondra physalodes</u>)	+	+	0	0	-	0	+	0	0	-	-	+	-	0	?	+	?
cocklebur (<u>Xanthium sacchoratum</u>)	-	+	-	-	-	-	?	-	-	-	-	-	-	-	?	?	?
galinsoga (<u>Galinsoga parviflora</u>)	0	?	0	-	0	0	+	+	0	-	-	-	-	0	0	+	0
lambsquarters (<u>Chenopodium album</u>)	+	+	0	0	0	+	+	0	+	0	0	+	0	0	0	?	+
pigweed (purslane) (<u>Portulaca oleracea</u>)	0	+	+	+	0	0	+	+	+	+	0	+	+	+	0	+	0
popolo (<u>Solanum nodiflorum</u>)	+	+	+	0	-	0	0	+	0	0	-	+	0	0	0	+	?
flora's paint brush (<u>Emilia sonchifolia</u>)	0	+	0	-	0	0	0	+	0	0	?	0	-	-	?	?	?
richardia (<u>Richardia scabra</u>)	-	+	0	0	0	0	+	+	?	-	-	+	-	-	?	+	?
spurge, garden (<u>Euphorbia hirta</u>)	+	+	?	+	+	?	+	+	?	+	+	?	+	+	?	?	?
swinecress (<u>Coronopus didymus</u>)	+	+	0	-	+	0	?	+	-	0	-	0	0	0	0	+	?

GUIDE FOR TRIAL USE OF HERBICIDES WITH VEGETABLE CROPS

All agricultural chemicals should be applied in accordance with the regulations of the Federal Food and Drug Administration on rates, timing, and crops for which the chemicals may be used. The recommendations given below conform to these regulations.

Rate per acre is given for overall field treatment. For band application rate use the following formula to calculate the rate:

$$\frac{\text{Spray band width (inches)}}{\text{Inches between crop row}} \times \text{Overall treatment rate in pounds or quarts} = \text{Pounds or quarts of chemical needed per acre for band application}$$

Apply spray applications of herbicides mixed with water (except petroleum solvent) at the rate of 40-100 gals/acre. Apply granular herbicides on dry soil and irrigate immediately after application with 1/2 acre-inch (13,500 gals/acre) of water. Apply granular herbicides on growing crops only when the foliage is dry to reduce foliar damage. Apply soil incorporated herbicides as a spray at the rate of 40-100 gals/acre on soil prepared for planting (fine texture without large soil clods) and immediately work into soil to a depth of 2-4 inches by cross disking or tilling with rotovator or merrytiller.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
BEANS, GREEN OR SNAP		
Vegadex (CDEC)	4-6 qts/acre 20% granules 20-30 lbs/acre	Apply after seed planting but before weeds and crop emerge. Weed control from 4 to 6 weeks. Plant seeds to a depth of 3/4 to 1 inch for DNBP plus CDEC and 1/2 inch for CDEC alone. Seeds planted at shallower depths may be injured. For best results, do not disturb soil after treatment. Apply granular herbicide to dry soil and apply irrigation water as soon as possible. Under sprinkler irrigation, apply 1/2 acre-inch (13,500 gals/acre) of water immediately after application of granules.
Vegadex (CDEC) plus Sinox PE or Premerge (DNBP, dinoseb)	4 qts/acre plus 4 qts/acre	Apply as above (Vegadex).
Eptam (EPTC)	2 qts/acre	Apply Eptam as a preplant treatment (spray on soil) and cross disk or till into soil immediately to a depth of 2 to 4 inches. Apply spray on well prepared soil ready for planting. Good grass control up to 3 to 4 months but poor control of some broadleaved weeds.

CROP/ CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
BEANS, GREEN OR SNAP (Continued)		
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply after seeding but before weeds and crop emerge. Apply with proper agitation of spray mixture. Weed control from 4 to 6 weeks.
Randex (CDA) plus Sinox PE or Premerge (DNBP, dinoseb)	4 qts/acre plus 4 qts/acre	Apply after seeding but before weeds and crop emerge. Plant seeds 3/4 to 1 inch deep to prevent injury.
Premerge or Sinox PE (DNBP, dinoseb)	8 qts/acre	Apply after seeding but before weeds and crop emerge. Plant seeds 3/4 to 1 inch deep to prevent injury.
Treflan (trifluralin)	3/4 qt/acre	Apply Treflan as a preplant treatment (spray on soil) and cross disk or till into soil immediately to a depth of 2 to 4 inches. Apply spray on well prepared soil ready for planting.
BEAN, LIMA		
Vegadex (CDEC)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as in green bean.
Treflan (trifluralin)	3/4 qt/acre	Apply as in green bean.
BEAN, SOY		
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply as in green bean.
Vegadex (CDEC)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as in green bean.
Treflan plus Sinox PE or Premerge (DNBP, dinoseb)	1 qt/acre plus 4 qts/acre	Apply as spray immediately after sowing seed and do not soil-incorporate-- that is, do not disk or till into soil.
Treflan (trifluralin)	1 qt/acre	Apply as in green bean.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
BROCCOLI, CAULIFLOWER, AND CABBAGE		
Vegadex (CDEC)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as a spray over direct seeded or transplanted crops before weeds emerge. Plant parts contacted by spray may be injured slightly. Apply granules when plant parts are dry immediately after seeding or transplanting.
Dacthal W-75 (DCPA)	10-14 lbs/acre	Apply as a spray over the transplanted crops only before weeds emerge. <u>Important:</u> Use sprayer equipped with agitator to prevent settling of wettable powder. Apply at least 1/2 acre-inch (13,500 gals/acre) of water immediately after treatment for best results.
Treflan (trifluralin)	1 qt/acre	Apply Treflan as a preplant treatment (spray on soil) and cross disk or till into soil immediately to a depth of 2 to 4 inches. Apply spray on well prepared soil ready for planting.
TOK E-25 (nitrofen)	4-8 qts/acre	Apply as a spray after seeding or as a directed spray after transplanting. Small weeds may be present at time of application. <u>Caution:</u> Over-the-plant sprays may cause injury.
CARROTS		
TOK E-25 (nitrofen)	4-8 qts/acre	Apply as a spray after seeding before crop emerges. Small weeds may be present at time of application.
Petroleum solvents	40-150 gals/acre	Apply when carrots are in 2- to 4-leaf stage. Do not apply later than 6 weeks before harvest.
Lorox 50W (linuron)	1-2 lbs/acre	Apply as a spray after seeding before crop and weeds emerge. <u>Caution:</u> Post-emergence use may reduce yields in Hawaii. Do not use in fields to be planted to other vegetable crops except sweet corn.
Chloro IPC (CIPC or chlorpropham)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as a spray or broadcast granules after seeding before crop and weeds emerge.
Treflan (trifluralin)	1 qt/acre	Apply Treflan as a preplant treatment (spray on soil) and cross disk or till into soil immediately to a depth of 2-4 inches. Apply spray on well-prepared soil ready for planting.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
CELERY		
Vegadex (CDEC)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply after transplanting but before weeds emerge. Do not apply later than 3 weeks after transplanting.
Petroleum solvents	40-100 gals/acre	Apply when crop produces first true leaves (2 to 4 weeks after transplanting) and before crown leaf-cups are formed.
TOK E-25 (nitrofen)	4-8 qts/acre	Apply as a spray after transplanting but before weeds are in 4-leaf stage.
Caparol 80W (prometryne)	2-1/2 - 4 lbs/acre	Apply within 2-6 weeks after transplanting. <u>Caution:</u> Do not use in fields to be planted to other vegetables crops except corn. Do not apply more than two treatments per crop.
CORN, SWEET		
Aatrex, 80W (atrazine)	1-1/2 - 3-3/4 lbs/acre	Apply after seeding but before weeds and crop emerge. Weed control from 8 to 12 weeks. <u>Caution:</u> Do not apply Aatrex to a corn crop to be followed by other vegetable crops because of injury from residue in the soil.
	2-1/2 - 3-3/4 lbs/acre	Apply as directed spray 3 weeks after corn emerges. <u>Caution:</u> Do not plant treated area to any crop except corn the following year.
Lorox 50W (linuron)	2-4 lbs/acre	Apply as directed spray when corn is 15 inches high or taller. Do not apply within 60 days of harvest. <u>Caution:</u> Do not apply Lorox to a corn crop to be followed by other vegetable crops except soybeans, carrot, and potato.
Caparol 80W (prometryne)	1-1/4 - 4 lbs/acre	Apply after seeding but before weeds and crop emerge. <u>Caution:</u> Do not plant treated area to any crop except corn or celery the following year.
Princep 80W (simazine)	2-1/2 - 5 lbs/ acre	Apply after seeding but before weeds and crop emerge. <u>Caution:</u> Do not apply more than 5 lbs. to corn in any one year. Do not plant treated area to any crop except corn the following year.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
CORN (Continued)		
Sutan (butylate)	2 qts/acre	Apply as a preplant treatment (spray on soil) and cross disk or till into soil immediately to a depth of about 4 inches. Apply spray on well-prepared soil ready for planting. <u>Caution</u> : May cause injury under some soil and climatic conditions.
Aatrex 80W (atrazine) plus Ramrod W-65 (propachlor)	1-1/2 - 2-1/2 lbs/A	Apply as Ramrod W-65.
Radox (CDAA)	4-6 qts/acre	Apply after seed planting but before crop and weeds emerge. Plant seed at a depth of 1 inch. Seeds planted at shallower depths may be injured. Apply 1/2 acre-inch (13,500 gals/acre) of water after granular application.
Vegadex (CDEC)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as above (Radox).
Radox (CDAA) plus Sinox PE	4 qts/acre plus 4 qts/acre	Apply as above (Radox).
Vegadex (CDEC) plus Sinox PE (DNBP, dinoseb)	4 qts/acre plus 4 qts/acre	Apply as above (Radox).
Ramrod W-65 (propachlor)	6-8 lbs/acre or 25 lbs/acre of 20% granules	Apply as a spray before crop and weeds emerge. Apply granular material on dry soil and irrigate immediately.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
CUCUMBER		
Alanap-3 (NPA, or naptalam)	6-8 qts/acre or 28-37 lbs/acre of 10.8% granules	Apply after seeding but before weeds and crop emerge. At vining stage before weeds emerge or after cultivation, broadcast granular form only. Spray after crop emergence will cause stunting and leaf deformation. Apply granules when plant parts are dry.
Vegadex (CDEC)	4 qts/acre 20 lbs/acre granules	Apply after seeding but before weeds and crop emerge. <u>Caution:</u> Do not use more than 4 qts/acre rate. Do not apply after crop emerges.
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply as a directed spray on soil around crops 4 to 6 weeks after seeding but before weeds emerge or after cultivation. <u>Caution:</u> Do not apply after seeding or on very young seedlings.
Alanap-3 (naptalam, NPA) plus	6-8 qts/acre	Apply after seeding but before weeds and crop emerge. <u>Caution:</u> Do not apply after crop emerges. Application to sandy soils and/or moderately wet soils may cause injury.
Premerge or Sinox PE (dinoseb, DNBP)	2.5 qts/acre	
Dyanap or Ancrack (naptalam, NPA) plus dinoseb, DNBP)	6-8 qts/acre	Apply as Alanap-3 plus Premerge or Sinox PE.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
CANTALOUPE		
Alanap-3 (NPA, or naptalam)	6-8 qts/acre or 28-37 lbs/acre of 10.8% granules	Apply after seeding but before weeds and crop emerge. At vining stage before weeds emerge or after cultivation, broadcast granular form only. Spray after crop emergence will cause stunting and leaf deformation. Apply granules when plant parts are dry.
Vegadex (CDEC)	4 qts/acre 20 lbs/acre granules	Apply after seeding but before weeds and crop emerge. <u>Caution:</u> Do not use more than 4 qts/acre rate. Do not apply after crop emerges.
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply as a directed spray on soil around crops 4 to 6 weeks after seeding but before weeds emerge or after cultivation. <u>Caution:</u> Do not apply after seeding or on very young seedlings.
EGGPLANT		
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply as a directed spray on soil around crops after transplanting before weeds emerge.
LETTUCE, ROMAINE; ENDIVE		
Vegadex (CDEC)	3-4 qts/acre or 15-20 lbs/acre of 20% granules	After after seeding before crop and weeds emerge. Plant seeds 1/4 to 1/2 inch deep. Seeds planted at shallower depths may be injured. <u>Caution:</u> Use on transplanted crops may cause injury.
Dacthal W-75 (DCPA)	6-8 lbs/acre	Apply as a spray 2 to 3 weeks after crop emerges or on transplanted crop before weeds appear or after cultivation. <u>Caution:</u> Do not apply after seeding or on very young seedlings.
Balan (benefin))	3-4 qts/acre	Apply as a spray on well prepared soil ready for planting and immediately cross disk or till into soil to a depth of 2 to 4 inches. <u>Caution:</u> Results may be erratic under Hawaiian conditions.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
PEAS		
Randex (CDAA)	3-4 qts/acre or 15-20 lbs/acre of 20% granules	Apply after seeding before weeds and crop emerge. <u>Caution:</u> Plant seeds 3/4 to 1 inch deep to prevent injury.
Randex (CDAA) plus Sinox PE or Premerge (DNBP, dinoseb)	3-4 qts/acre plus 4 qts/acre	Apply as above (Randex). <u>Caution:</u> Plant seeds 3/4 to 1 inch deep to prevent

PEANUTS

Dymid or Enide plus Sinox PE (Premerge)	5 lbs/acre or 8 lbs/acre plus 4 qts/acre	Apply this mixture after seeding before weeds and crop emerge. <u>Caution:</u> Plant seeds 3/4 to 1 inch deep to prevent injury.
Sinox PE or Premerge (DNBP, dinoseb)	8 qts/acre	Apply after seeding but before weeds and crop emerge. <u>Caution:</u> Plant seeds 3/4 to 1 inch deep to prevent injury.
Dymid 80W or Enide 50W (diphenamid)	5-7 lbs/acre or 8-12 lbs/acre	Apply after seeding before weeds and crop emerge.

PEPPER, TRANSPLANTS

Dymid 80W or Enide 50W (diphenamid)	5-7 lbs/acre or 8-12 lbs/acre	Apply directly over plants immediately after transplanting or before weeds emerge.
Dacthal W-75 (DCPA)	10-14 lbs/acre	Apply as directed spray to transplanted crop and irrigate immediately with at least 1/2 acre-inch (13,500 gals/acre) of water for best results. Use equipment with adequate agitation to prevent settling of wettable powder.
Treflan (trifluralin)	1 qt/acre	Apply as a spray and work into soil immediately to a depth of 2 to 4 inches by cross disking or tilling.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
MUSTARD GREENS		
Vegadex (CDEC)	4 qts/acre or 20 lbs/acre of 20% granules	Apply after seeding before weeds and crop emerge. Plant seeds at a depth of 1/4 to 1/2 inch to prevent injury to germinating seeds. <u>Caution:</u> Use on transplanted crop may cause injury.
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply after seeding before weeds and crop emerge. Plant seeds to a depth of 1/4 to 1/2 inch to prevent injury to germinating seeds. <u>Caution:</u> Use on transplanted crop may cause injury unless spray directed.
TOK E-25 (nitrofen)	4-8 qts/acre	Apply as a spray after seeding before crop emerges. Small weeds may be present at time of application.
ONIONS, DIRECT SEEDED		
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply after seeding before weeds emerge. For best results, irrigate with at least 1/2 acre-inch (13,500 gals/acre) of water immediately after treatment. Apply spray with sprayer equipped with agitator.
ONIONS, TRANSPLANTS		
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply after transplanting before weeds emerge. Apply with sprayer equipped with agitator. For best results, irrigate with at least 1/2 acre-inch (13,500 gals/acre) of water immediately after treatment.
Randex (CDA A)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as a directed spray or broadcast granules on transplanted crop within 45 days of harvest. For best results, apply 1/2 acre-inch (13,500 gals/acre) of water immediately after granular application.
Chloro-IPC (CIPC, chlorpropham)	4-6 qts/acre or 20-30 lbs. or 20% granules	Broadcast granules on established transplanted crops (2 to 4 weeks old) before weeds emerge or after cultivation. <u>Caution:</u> Do not use within 30 days of harvest.
Randex (CDA A) plus Chloro IPC (CIPC, chlorpropham)	20 lbs of 20% granules plus 20 lbs of 20% granules	Apply as above (Chloro-IPC). <u>Caution:</u> Do not use within 45 days of harvest.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
POTATO, IRISH		
Premerge or Sinox PE (dinoseb, DNBP)	8 qts/acre	Apply as a pre-emergence spray in 40 to 100 gallons of water before crop and weeds emerge.
Lorox 50W (linuron)	2 lbs/acre	Apply as a pre-emergence spray in 40 to 100 gallons of water before crop and weeds emerge. Do not plant other vegetable crops except sweet corn and carrots for 3 to 6 months on field treated with Lorox.
Paraquat CL (paraquat)	1 qt/acre	Apply as a preharvest vine killer in 40 to 100 gallons of water. Do not apply within 3 days of harvest. Do not make more than two applications within a minimum of 5 days between application. Do not pasture livestock in treated fields.

POTATO, SWEET

Dacthal W-75 (DCPA)	10-14 lbs/acre	Apply as a spray over the planted cuttings before weeds emerge. <u>Important:</u> At least 1/2 acre-inch (13,500 gals/acre) of water must be applied immediately after treatment for best results. Sprayer should have adequate agitation to prevent settling of wettable powder.
Dymid 80W or Enide 50W (diphenamid)	5-7 lbs/acre or 8-12 lbs/acre	Apply as a pre-emergence spray over transplanted crop.
Randox (CDAA)	4-6 qts/acre or 20-30 lbs/acre of 20% granules	Apply as a pre-emergence spray over transplanted crop.
Dacthal W-75 (DCPA) Plus	10-14 lbs/acre	Apply as Dacthal W-75
Dymid 80W or Enide 50W (diphenamid)	5-7 lbs/acre or 8-12 lbs/acre	

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
SQUASH, ZUCCHINI		
Vegadex (CDEC)	4 qts/acre or 20 lbs/acre of 20% granules	Apply after seeding before weeds and crop emerge.
Dacthal W-75 (DCPA)	10-14 lbs/acre	Apply as a directed spray on soil around plants 4 to 6 weeks after seeding but before weeds emerge or after cultivation.
TOMATO		
Dymid 80W or Enide 50W (diphenamid)	5-7 lbs/acre or 8-12 lbs/acre	Apply as a pre-emergence spray in 40 to 100 gallons of water on direct seeded or transplanted crop not later than a day after seeding or transplanting.
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply as a pre-emergence directed spray to base of plants at 4 to 6 weeks after transplanting in 40 to 100 gallons of water and irrigate immediately with at least 1/2 acre-inch (13,500 gals/acre) of water for best results. Sprayer should have adequate agitation to prevent settling of wettable powder.
Tillam (pebulate)	2-3/4 qts/acre	Apply as a preplant soil treatment for transplanted tomatoes. Spray on soil and disk into soil immediately to a depth of 2 to 4 inches. Apply on well prepared soil ready for planting. Nutgrass and other grasses controlled for at least 3 to 4 months.
Aromatic oil	20-40 gals/acre	Apply as a post-emergence directed contact spray between plant rows. Apply when weeds are less than 2 inches high and avoid contact with tomato plant parts. Severe plant injury will result if spray is not directed carefully. Do not use aromatic oil fortified with pentachlorophenol or sodium pentachlorophenate on growing crops.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
TOMATO (Continued)		
Treflan (trifluralin)	1 qt/acre	Apply as a preplant soil incorporated treatment for transplanted tomatoes. Apply as a spray on soil well prepared for planting in 40 to 100 gallons of water and immediately disk or till into soil to a depth of 2 to 4 inches before planting. Excellent control of grassy weeds. Apply at 4 to 6 weeks as directed spray to direct seeded or transplanted tomatoes and soil incorporate immediately.
Vegadex (CDEC)	4-6 qts/acre or 20-30 lbs/acre granules	Apply as a directed spray immediately after transplanting before weeds emerge. Apply granules when plant parts are dry.
TURNIP		
Dacthal W-75 (DCPA)	10-14 lbs/acre	Apply after seeding before weeds and crop emerge. For best results apply 1/2 acre-inch (13,500 gals/acre) of water immediately after treatment. Apply with sprayer equipped with adequate agitation to prevent settling of wettable powder.
Vegadex (CDEC)	4 qts/acre or 20 lbs/acre of 20% granules	Apply after seeding before weeds and crop emerge.
TOK E-25 (nitrofen)	4-8 qts/acre	Apply after seeding before crop emerges. Small weeds may be present at time of application.

CROP/CHEMICAL	RATE OF COMMERCIAL FORMULATION	METHOD AND TIME OF APPLICATION AND COMMENTS
WATERMELON		
Alanap-3 (NPA-sodium salt, naptalam)	6-8 qts/acre or 28-37 lbs/acre of 10.8% granules	Apply after seeding but before weeds and crop emerge as a spray in 40 to 100 gallons of water per acre at vining stage before weeds emerge or after cultivation. Broadcast granular form only when plant parts are dry. Sprays used at vining stage will cause stunting and leaf deformation.
Dacthal W-75 (DCPA)	8-14 lbs/acre	Apply as a directed spray on soil around crops 4 to 6 weeks after seeding but before weeds emerge or after cultivation.
Vegadex (CDEC)	4-6 qts/acre	Apply after seeding but before weeds and crop emerge.

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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