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# 1986 *Weed Control Guide* for *Vegetable Crops*



Cooperative Extension Service  
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# 1986 Weed Control Guide for Vegetable Crops

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## Table of Contents

<i>Crop</i>	<i>Page</i>	<i>Crop</i>	<i>Page</i>
ASPARAGUS .....	5	PARSLEY .....	10
BEANS (SNAP AND LIMA) .....	6	PARSNIPS .....	10
BEETS (RED) .....	7	PEAS .....	11
BROCCOLI .....	7	PEAS (SOUTHERN) .....	11
BRUSSELS SPROUTS .....	7	PEPPERS .....	11
CABBAGE .....	7	POTATOES .....	12
CARROTS .....	7	PUMPKINS .....	13
CAULIFLOWER .....	7	RHUBARB .....	13
CELERY .....	8	RUTABAGA .....	13
COLLARDS .....	10	SPINACH .....	13
CUCUMBERS .....	8	SQUASH .....	13
DILL .....	9	STRAWBERRIES .....	13
EGGPLANT .....	9	SWEET CORN .....	14
ENDIVE .....	9	SWEET POTATOES .....	15
ESCAROLE .....	9	TOMATOES .....	15
GREEN ONIONS .....	10	TURNIP .....	13
HORSERADISH .....	9	TURNIP GREENS .....	10
KALE .....	10	WATERMELONS .....	16
LETTUCE .....	9		
MUSKMELONS .....	9	NAMES, SOURCES, AND FORMULATIONS OF HERBICIDES USED ON VEGETABLE CROPS .....	18
MUSTARD .....	10		
NON-CROP LAND .....	16	EFFECTIVENESS OF HERBICIDES ON WEEDS .....	19
OKRA .....	10		
ONIONS .....	10		

### OTHER EXTENSION PUBLICATIONS WITH INFORMATION ON WEED CONTROL

These publications are available from your county Cooperative Extension Service office, or from the MSU Bulletin Office, P.O. Box 6640, East Lansing, MI 48823-6640. Prices are subject to change due to revisions. Contact your county office for current prices.

E-154	Fruit Pesticide Handbook	\$1.85	E-1517	Poison Ivy Control	\$0.25
E-434	Weed Control Guide for Field Crops	\$0.60	E-1858	Using Spray Additives with Herbicides	\$0.40
E-653	Lawn Weed Control Guide	\$0.20	NCR-158	Herbicide Symptoms in Dry Edible Beans	\$0.25
E-791	Problem Perennial Weeds in Michigan	\$1.00	NCR-164	Nightshade Control in Field Crops	\$0.15
E-1215	A Quick Test for Atrazine Carryover	\$0.20	NCR-185	Comprehensive Guide to Tolerance and Susceptibility of Weeds and Crops to Herbicides	\$0.80
E-1296	Herbicide-Fertilizer Combinations	\$0.10	NCR-281	Weeds of the North Central States	\$2.50
E-1363	Guide to the Identification of Common Weed Seedlings of Michigan	\$0.65			

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## BASIC PRINCIPLES OF WEED CONTROL WITH HERBICIDES

Weeds reduce crop yields by competing with crops for water, nutrients, and light. Some weeds release toxins that inhibit crop growth, and others may harbor insects, diseases, or nematodes that attack crops. Weeds often interfere with harvesting operations, and sometimes contamination with weed seeds or other plant parts may render a crop unfit for market. Profitable crop production depends on effective weed control.

Effective weed control in vegetable crops requires the use of a combination of management techniques, cultural methods, and herbicides. Growing the same crop year after year and using the same weed control techniques will encourage the development of problem weeds. Rotation of crops, herbicides, and tillage methods will help reduce this problem. Perennial weeds such as quackgrass, yellow nutsedge, or Canada thistle should be killed with herbicides the year before planting vegetable crops. Small infestations of perennial weeds should be eradicated immediately with spot sprays. Whenever possible, weeds should be prevented from producing seeds to help reduce infestation in future years.

**Types of herbicides:** PREEMERGENCE herbicides kill germinating weed seedlings in the soil. They may be applied and mixed into the soil prior to planting (pre-plant incorporated) or applied to the soil surface after planting and before weeds emerge. Most soil-applied herbicides require soil moisture to be effective. Best weed control will be obtained when these herbicides are carried into the soil by rainfall or sprinkler irrigation. In general, lower rates of preemergence herbicides are used on sandy (coarse-textured) soils than are used on clays or mucks (fine-textured) soils to obtain the same level of control.

POSTEMERGENCE herbicides are applied to the foliage of plants. They may burn off the tops of weeds (contact herbicides) or they may be translocated throughout the plants and kill the growing points (translocated or systemic herbicides). Translocated postemergence herbicides are effective against perennial weeds.

## REGISTRATION OF HERBICIDES

Recommendations in this bulletin are based on field trials conducted in Michigan and other North Central states over a period of several years. Herbicides must be registered with the U.S. Environmental Protection Agency and the Michigan Department of Agriculture before they can be legally used in Michigan. Use of a herbicide in a manner not consistent with the label can lead to fines or condemnation of the crop.

The pesticide label is a legal document on pesticide use. Read it carefully and follow all instructions. Do not mix and apply together pesticides if it is forbidden on labels. Mixes recommended in this bulletin are legitimate.

## THE USE OF HERBICIDES

### Equipment

A weed control sprayer should be made of non-corrosive materials, easy to clean, and have the seven following features.

1. A **tank** with a volume of 100-300 gallons to reduce filling and mixing operations.
2. A **pump** with a capacity of at least 10 gallons per minute and pressure up to 100 pounds per square inch (PSI).
3. An **agitation system**—The bypass from the pressure control is a good source of agitation. Direct the bypass line into the bottom of the tank.
4. **Screens**—There should be 50 mesh screens in the intake line and at each nozzle.
5. **Pressure gauge**—The pressure gauge should be able to accurately measure pressures up to 100 PSI.
6. **Adjustable spray boom**—boom should be adjustable from 18 to 36 inches above the ground.
7. **Nozzles**—Flat fan nozzles with 73 to 95° angles are best suited for most weed control work. Nozzle volume can vary from 1 to 10 gallons per minute, depending on the application. 8002 or 8004 are good general-use nozzles.

### Sprayer Calibration

One of the most important factors in effective weed control is accurate calibration of the equipment. The following steps can be used as a guide to calibrate a ground sprayer.

1. Determine the desired application volume of carrier (usually water) in gallons per acre (GPA). For most weed control applications, 10-30 GPA at 30-40 PSI is sufficient.
2. Adjust the boom height so that the spray overlaps about 30% at the ground (or other surface to be sprayed). With 80° nozzles, this places the nozzles about 20 inches apart on the boom and 20 inches above the sprayed surface. Check each nozzle at the recommended pressure for output. Replace any defective nozzles and screens.
3. Fill the spray tank and system with water.
4. Spray a measurable area in the field, at a fixed speed and at the desired pressure. Spray at least 20% of the total tank volume and at least 2 acres of area.
5. Measure the volume of water (in gallons) needed to refill the tank.
6. Determine the area (in acres) that was test sprayed using the following formula: length of area sprayed (in feet) × boom width (in feet) ÷ 43,560 = acres sprayed.

7. Divide the volume sprayed by the area sprayed to obtain the actual output of the sprayer in gallons per acre.

8. Make adjustments to tractor speed, pressure, or nozzle size and repeat steps 3-7 to change application rate.

9. Calculate the amount of formulated pesticide needed to treat the desired area.

**Band application**—The expense of herbicide application can be reduced by spraying bands over the crop rows rather than the whole field (broadcast application). When spraying in bands, adjust the amount of herbicide for the area actually sprayed, rather than the total acreage. The amount of chemical per gallon of carrier will remain the same. Use even spray nozzles (e.g., 8004E) rather than tapered spray nozzles (e.g., 8004) for band applications.

### PESTICIDE USE PRECAUTIONS

Handle herbicides, like all pesticides, with extreme caution and respect. There are 3 good reasons for using pesticides safely and wisely:

1. To protect yourself and others from poisoning.
2. To avoid harming and polluting the environment.
3. To avoid crop injury.

Pesticide accidents occur most often during mixing and tank filling operations. Although accidental ingestion of chemicals is considered to be the greatest health hazard, there is also great danger of poisoning when pesticides contact skin or eyes and when the dust or vapors are inhaled. Protective clothing should be worn at all times during the handling and application of pesticides and the cleaning of spray equipment. Such equipment should include chemical resistant gloves and boots, goggles, and a respirator. Heed all the precautionary statements on the product label and cover-up to protect yourself.

Using more chemical than recommended on the label is illegal and can result in the carryover of residues in the soil. Pesticides may also leach into ground and surface water. Herbicide residues can also damage sensitive crops the following year. Some long-residual herbicides last more than one year in the soil; keep this in mind when planning a crop rotation program. The herbicides recommended in this bulletin should dissipate in one growing season unless otherwise noted. Check the product labels for precautions on rotational crops.

Herbicides offer an effective and economical means of weed control. Crop plants are seldom completely resistant to herbicide injury, but have some level of tolerance. The ability of a herbicide to kill weeds without harming crop plants (selectivity) may be partially lost under unfavorable weather conditions. Herbicide drift to non-target crops often results in crop injury. Do not spray under windy conditions.

### CLEANING PESTICIDE SPRAYERS

It is important to clean weed control sprayers after use, especially if they are used for more than one crop and for application of insecticides and fungicides. The need for extensive cleaning can be minimized if one sprayer is dedicated to herbicide application only.

Do not use a sprayer to apply insecticides or fungicides if the sprayer has been used to apply 2,4-D type herbicides.

When cleaning a sprayer used only for herbicide application, only water rinsing is necessary. Rinse the whole sprayer with water, inside and out, including boom, hoses, and nozzles. Partially fill the spray tank with water and keep the pump running so that the water is circulated throughout the entire system. Spray the water out through the nozzles. Repeat process when changing herbicides and at the end of each day.

Clean sprayers completely when changing from herbicides to other pesticides. Add one gallon of ammonia to 100 gallons of water. Pump it through the system. Leave the cleaning solution in the sprayer system for at least two hours and then pump it out through the nozzles. Do not apply rinsate to crops. Rinse the system with water after draining the rinsate. Do not leave pesticide solution or cleaning solution in the tank overnight.

### PESTICIDE STORAGE AND DISPOSAL

Reduce the need for and the hazards of pesticide storage and disposal by buying only what will be used during a growing season and mixing only what is needed for each application. In addition, try to apply leftovers, water-rinsates, etc., to the appropriate crop rather than storing or disposing of it. Long-term storage may reduce the effectiveness and/or increase the toxicity of herbicides.

If storage is necessary, choose a suitable environment that is dry, cool, and out of direct sunlight. Avoid extreme heat or cold. Place in a location that is not accessible to children and animals and that is not near food, feed, or water. Keep pesticides under lock and key when not in use. Store pesticides in their original containers. Store herbicides separately from insecticides and fungicides to prevent possible interaction. Check the product label for specific storage recommendations.

Always triple rinse pesticide containers immediately after emptying. Then, crush or puncture rinsed containers to prevent misuse. Dispose of rinsed containers in a licensed sanitary landfill or recycle through a scrap metal dealer. Consult the phone directory for scrap metal dealers and contact your county Cooperative Extension Service office for the nearest landfills. Also, the product label will have important information on disposal; consult it.

# WEED CONTROL RECOMMENDATIONS FOR VEGETABLE CROPS

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Amount of Commercial Formulation/Acre	Remarks and Limitations
ASPARAGUS (Seedlings or newly planted crowns)	Germinating or emerged annuals	linuron (LOROX) (4 L)	½ - 1½	½ - 1½ qt	Apply before emergence and after fern is 6 inches high. Plant seed at least 1 inch deep; use 1 lb rate postemergence. Do not exceed 2 lb a.i./acre/year. Does not control crabgrass postemergence. Pre-emergence weed control will be reduced in soils with organic matter greater than 5%
	Germinating annuals	chloramben (AMIBEN DS) (75% DS)	2 - 3	2½ - 4 lb	Apply before asparagus and weeds emerge. Use lowest rate on sandy soils. If soil is dry, irrigate after application.
ASPARAGUS (Seedlings)	Germinating annuals	terbacil (SINBAR) (80 WP)	0.8 - 1.6	1 - 2 lb	Spray 300 lb/acre activated charcoal in a 1 inch band over rows at planting. Then apply Sinbar. One-half inch moisture within 2 weeks of application will improve control. Do not use on soils with less than 1% organic matter. Do not plant any crop other than asparagus within 2 years of application. Use lowest rate on sand and sandy loam soils.
		paraquat (PARAQUAT PLUS) (2 lb/gal)	¾	1 qt	Apply after weeds emerge, but before asparagus emerges. For maximum knockdown, add a surfactant at 1 qt/100 gal of spray solution.
	Germinating annuals	diuron (KARMEX) (80 WP)	2 - 3	2½ - 4 lb	Apply after tillage or chopping fern in the spring and again after the harvest season, if necessary. Apply before weeds emerge. Total dosage should not exceed 4.8 lb a.i./acre/year.
ASPARAGUS (Established one year or more)	Germinating or emerged annuals	simazine (PRINCEP) (80 WP)	2 - 4	2½ - 5 lb	Apply after tillage or chopping fern in the spring and again after the harvest season, if necessary. Apply before weeds emerge. Total dosage should not exceed 4 lb a.i./acre/year.
		napropamide (DEVIRINOL) (50 WP)	4	8 lb	Apply before emergence in the spring and incorporate 1 to 2 inches. Gives good grass control.
	Germinating or emerged annuals	linuron (LOROX) (4 L)	¾ - 2	¾ - 2 qt	Apply before or after crop emergence. Use high rate preemergence. Make 1 to 4 applications of ¾ to 1 lb a.i./acre postemergence. Do not apply within 1 day of harvest. Do not exceed 4 lb a.i./acre/year. Does not control crabgrass postemergence. Preemergence control will be reduced in soils with organic matter greater than 5%.
Germinating annuals, Sandbur	Germinating annuals, Sandbur	metribuzin (SENCOR, LEXONE) (4 F)	1 - 2	1 - 2 qt	Apply after tillage or chopping fern in the spring and again after the harvest season, if necessary. Apply before weeds emerge. Total dosage may not exceed 2 lb a.i./acre/year. Two applications are necessary for good season-long sandbur control.
		terbacil (SINBAR) (80 WP)	1.2 - 2.4	1½ - 3 lb	Apply prior to spear emergence or after a clean cutting. Do not use on soils with less than 1% organic matter. Do not apply to diseased plants. Do not apply more than 2.4 lb a.i./acre/year. Do not apply more than 2 applications per year. Do not plant to any crop other than asparagus within 2 years of application. Use lowest rate on sandy and sandy-loam soils.

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Commercial Amount of Formulation/Acre	Remarks and Limitations
	Emerged annuals	paraquat (PARAQUAT PLUS)	$\frac{1}{2}$ - 1	1 - 2 qt	Apply before crop emergence or after the last harvest. Include a non-ionic surfactant. Six day harvest restriction.
	Quackgrass	glyphosate (ROUNDUP) (3 lb./gal)	1 $\frac{1}{2}$	2 qt	Apply immediately after the last harvest when all spears are snapped off. Do not let herbicide contact fern. Roundup is most effective when applied to actively growing quackgrass just before seed stalks appear.
		dalapon (DOWPON) (85% salt)	8.5	10 lb	Apply before, during, or at the end of the harvest season when quackgrass is 4-6 inches high, and again 3-4 weeks later. During the harvest season, spray immediately after a harvest. Do not spray fern.
	Emerged perennials, marestail, volunteer asparagus	glyphosate (ROUNDUP) (3 lb./gal)	1 $\frac{1}{2}$ - 3	2 - 4 qt	Apply immediately after the last harvest when all spears are snapped off. Do not let herbicide contact emerged spears or fern. Include $\frac{1}{2}$ qt non-ionic surfactant per acre. Spot spray weeds that escape first application.
		2,4-D Alkanolamine salts (FORMULA 40) (4 lb./gal)	2	2 qt	Apply before, during, or after the harvest season when weeds are growing rapidly. During the harvest season spray immediately after a harvest to minimize injury to asparagus. When spraying after the harvest season, use drop nozzles to avoid spraying fern.
<b>BEANS</b> (snap, lima)	Emerged annuals	paraquat (PARAQUAT PLUS)	$\frac{1}{2}$ - 1	1 - 2 qt	Apply before or after seeding but before crop emergence. Include a non-ionic surfactant.
	Quackgrass	glyphosate (ROUNDUP) (3 lb./gal)	1 $\frac{1}{2}$	2 qt	Apply to 8 to 10 inch tall quackgrass in the fall or spring prior to planting. Allow at least 5 days prior to plowing.
	Germinating broadleaves and some grasses	chloramben (AMIBEN DS) (75% DS)	2 - 3	2 $\frac{1}{2}$ - 4 lb	Apply before emergence. If possible, apply when soil is moist. Use high rate on heavy, high-organic-matter soils, and for black nightshade control. Do not use on very light sandy soils.
		dimoseb (PREMERGE) (3 lb./gal)	3 - 6	4 - 8 qt	Apply before emergence to crook stage on beans. When applying at crook stage use lower rate. If possible, apply when soil is moist.
	Germinating grasses and some broadleaves	EPTC (EPTAM) (7 E)	3	2 qt	Apply before planting. Incorporate into soil 2 to 4 inches immediately after spraying. Gives good nutsedge, quackgrass, and annual grass suppression. Do not use on lima beans.
		metolachlor (DUAL) (8 E)	1 $\frac{1}{2}$ - 3	$\frac{1}{4}$ - 1 $\frac{1}{2}$ qt	Use lower rate on sandy soils with less than 3% organic matter. Incorporate 1 to 2 inches before planting, or apply preemergence after planting.
		trifluralin (TREFLAN 4 EC)	$\frac{1}{2}$ - $\frac{3}{4}$	$\frac{1}{2}$ - $\frac{3}{4}$ qt	Apply before planting. Incorporate into soil 2 to 3 inches soon after spraying. Use lowest rate on sandy soils. Does not control ragweed.
	Emerged annuals, yellow nutsedge, Canada thistle	bentazon (BASAGRAN) (4 lb./gal)	$\frac{1}{2}$ - 1	$\frac{1}{2}$ - 1 qt	Apply after beans have more than 1 expanded trifoliolate leaf, or injury will occur. Two applications are needed for nutsedge and Canada thistle control. Do not apply more than 2 lb a.i./acre/year.

<b>BEETS</b> (Red)	Germinating and emerged annuals	pyrazon (PYRAMIN RB) (75 WP)	3 - 4	4 - 5 lb	Apply from planting to before weeds are 1 inch high. On muck soils, better control is obtained by spraying small weeds after beets have two true leaves. Add crop oil at 1 gal/40 gal of spray or a surfactant such as X-77 at 1 pt/50 gal of spray.
	Germinating annuals	cycloate (RO-NEET 6E)	3 - 4	2 - 3 qt	Apply before planting. Incorporate into soil 2 to 3 inches after spraying. Use lowest rate on sandy soils. Not effective on muck soils.
	Emerged broadleaves	diethyl-ethyl (ANTOR 4 ES)	3 - 6	3 - 6 qt	Apply and incorporate 1-2 inches before seeding, or apply preemergence after seeding to moist soil. Needs rain or irrigation for activation. Use only on beets for processing.
	Emerged broadleaves	phenmedipham (SPIN-AID) (1.3 EC)	1	3 qt	Apply after beets have 4 true leaves. Use no more than 22 gal spray solution per acre. Do not apply if beets are under any type of stress. CHECK LABEL FOR WEEDS CONTROLLED AND PRECAUTIONS. Does not control redroot pigweed. 60 day harvest restriction.
	Perennials	glyphosate (ROUNDUP) (3 lb/gal)	1½ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>BROCCOLI, BRUSSELS SPROUTS, CABBAGE, CAULIFLOWER</b> (Seeded or transplanted)	Emerged annuals	paraquat (PARAQUAT PLUS)	½ - 1	1 - 2 qt	Apply before or after seeding but before crop emergence. Include a non-ionic surfactant.
	Germinating grasses and broadleaves	trifluralin (TREFLAN) (4 EC)	½ - ¾	½ - ¾ qt	Apply before seeding or transplanting. Incorporate into soil 2 to 3 inches soon after spraying. Use lowest rate on sandy soils and highest rate on soils high in clay or organic matter. Not effective on muck soils.
	Perennials	napropamide (DEVRIKOL) (50 WP)	1 - 2	2 - 4 lb	Apply before seeding or transplanting and incorporate 1-2 inches deep. May be applied after planting: irrigate within 24 hours and soak soil 2-4 inches.
	Perennials	DCPA (DACTHAL 75 WP)	8 - 10	10 - 13 lb	Apply after seeding or transplanting and before weeds germinate. Not effective on muck soils.
	Perennials	glyphosate (ROUNDUP) (3 lb/gal)	1½ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>CARROTS</b>	Germinating or emerged annuals	linuron (LOROX) (4 L)	½ - 1½	½ - 1½ qt	Apply before emergence and after carrots are 3 to 4 inches high. Use higher rate on weeds more than 2 inches high. Do not apply over carrots when temperature exceeds 85° F. and do not apply at pressures greater than 40 psi. Do not mix with other pesticides or wetting agents. Do not apply within 2 days of an application of Stoddard solvent. Do not exceed 2 lb a.i./acre/year.
	Selected germinating annuals	chlorpropham (FURLOE- CHLORO IPC) (4 E)	4	4 qt	Apply before carrots emerge. Provides weed control for 3 to 4 weeks on muck soil. Extremely effective on chickweed, smartweed, and field dodder.
	Emerged annuals	stoddard solvent (several trade names)	40 - 60 gallons		Apply after carrots have 2 true leaves. Do not spray within 42 days of harvest. Do not apply within 14 days after applying Lorox.

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Amount of Commercial Formulation/Acre	Remarks and Limitations
	Perennials	glyphosate (ROUNDUP) (3 lb./gal)	1½ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>CARROTS</b> (Mineral soil)	Germinating grasses and some broadleaves	trifluralin (TREFLAN 4 EC)	½ - 1	½ - 1 qt	Apply before planting. Incorporate into soil 2 to 3 inches soon after spraying. Use lowest rate on sandy soils. Does not control ragweed.
<b>CELERY</b> (Transplanted)	Germinating or emerged annuals	prometryne (CAPAROL 4 L)	1 - 2	1 - 2 qt	Make 2 applications, 2 and 6 weeks after transplanting and before weeds are 2 inches high. Do not exceed 4 lb a.i./acre/year.
		linuron (LOROX) (4 L)	1	1 qt	Apply after transplanting and before weeds are 2 inches high. Do not exceed 40 psi pressure. Do not apply when temperatures exceed 85° F. and do not mix with wetting agents or other pesticides.
<b>CELERY</b> (Outdoor seedbeds)	Emerged annuals	stoddard solvent (several trade names)	50 - 60 gallons		Apply after celery has formed true leaves.
<b>CUCUMBERS</b> (seeded)	Emerged annuals	paraquat (PARAQUAT PLUS)	½ - 1	1 - 2 qt	Apply before or after seeding but before crop emergence. Include a non-ionic surfactant.
	Germinating broadleaves and grasses	naptalam (ALANAP) (2 lb./gal) plus bensulide (PREFAR) (4 E)	3 - 4 plus 4 - 6	6 - 8 qt plus 4 - 6 qt	Apply after planting or in a split application. With irrigation, apply the two chemicals in a tank mix and irrigate immediately. With no irrigation, apply bensulide prior to planting and incorporate 2 to 3 inches. Apply naptalam to surface after planting. Use the lowest rates on sandy soils. A second application of naptalam can be made a month after planting, before cucumbers vine out.
		naptalam (ALANAP) (2 lb./gal) plus dinoseb (PREMERGE) (3 lb./gal)	4 plus 2	8 qt plus 3 qt	Apply before cucumbers emerge. Plant seed to a depth of at least 1 inch or injury may result. Do not use on sandy soils.
<b>CUCUMBERS</b> (Transplanted)	Germinating broadleaves	naptalam (ALANAP) (2 lb./gal)	4	8 qt	Apply before or after transplanting and before weeds emerge. Irrigate after application if soil is dry. Apply with bensulide before planting when grasses are a problem.
	Germinating grasses	bensulide (PREFAR 4 E)	6	6 qt	Apply before transplanting. Irrigate or incorporate into top 2 inches of soil.
	Germinating broadleaves and grasses	dinoseb (PREMERGE) (3 lb./gal)	2	3 qt	For use under clear plastic mulch. Apply to well prepared soil in spring and lay plastic immediately. Wait 2 weeks before transplanting.



<b>DILL</b>	Emerged annuals	stoddard solvent	40-60 gallons		Apply after two true leaves are formed.
<b>EGGPLANT</b>	Germinating annuals	DCPA (DACTHAL 75 WP)	8	11 lb	Apply after transplanting and before weeds emerge.
		napropamide (DEVRINOL) (50 WP)	1-2	2-4 lb	Apply before transplanting. Incorporate into the soil 1 to 2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils. Carry-over the following year may affect sensitive crops, especially small grains.
<b>ENDIVE, ESCAROLE</b>	Germinating annuals, quack grass	pronamide (KERB) (50 WP)	1-1½	2-3 lb	Apply before or after seeding and before weeds emerge. Must be incorporated or irrigated into soil. Can be applied post-emergence to crop. Weed control will be marginal on muck soil.
<b>HORSERADISH</b>	Germinating annuals	DCPA (DACTHAL 75 WP)	8-10	11-13 lb	Apply after seeding and before weeds emerge. Not effective on muck soils.
	Perennials	glyphosate (ROUNDUP) (3 lb/gal)	1½-2	2-3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>LETTUCE</b>	Germinating annuals, quack-grass	pronamide (KERB) (50 WP)	1-2	2-4 lb	Apply before or after seeding lettuce and before weeds emerge. Must be incorporated or irrigated into soil. Can be applied post-emergence to lettuce. Use high rate on muck soils; weed control will be marginal.
	Germinating annuals, especially grasses	benfen (BALAN) (1.5 LC)	1-1½	3-4 qt	Apply before planting. Incorporate into soil 2 to 3 inches immediately after spraying. Not effective on muck soils.
	Perennials	glyphosate (ROUNDUP) (3 lb/gal)	1½-2	2-3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>MUSKMELONS</b> (Transplanted)	Emerged annuals	paraquat (PARAQUAT PLUS)	½-1	1-2 qt	Apply before planting to kill emerged weeds. Include a non-ionic surfactant.
	Germinating broadleaves	naptalam (ALANAP) (2 lb/gal)	4	8 qt	Apply before or after transplanting and before weeds emerge. If soil is dry, irrigate after application. When grasses are a problem, use with PREFAR before planting.
	Germinating grasses	bensulide (PREFAR 4 E)	6	6 qt	Apply before transplanting. Irrigate or incorporate into soil 2 to 3 inches immediately after spraying.
	Germinating broadleaves and grasses	naptalam (ALANAP) (2 lb/gal) plus dinoseb (PREMERGE) (3 lb/gal)	4 plus 2	8 qt plus 3 qt	Apply before transplanting. Can be utilized under clear plastic mulch. Wait 5 days before transplanting.

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Amount of Commercial Formulation/Acre	Remarks and Limitations
MUSTARD, KALE, TURNIP GREENS, COLLARDS	Germinating annuals	DCPA (DACTHAL 75 WP)	8 - 10	11 - 13 lb	Apply after seeding and before weeds emerge. Not effective on muck soils.
	Perennials	trifluralin (TREFLAN 4 EC)	$\frac{1}{2}$ - $\frac{3}{4}$	$\frac{1}{2}$ - $\frac{3}{4}$ qt	Apply before planting. Incorporate into soil 2 to 3 inches soon after spraying. Use lowest rate on sandy soils. Not effective on muck soils.
OKRA (Seeded or transplanted)	Germinating annuals	glyphosate (ROUNDUP) (3 lb/gal)	1 $\frac{1}{2}$ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
	Germinating annuals	metolachlor (DUAL 8 E)	1 $\frac{1}{2}$ - 3	$\frac{3}{4}$ - 1 $\frac{1}{2}$ qt	May be preplant incorporated or applied preemergence.
ONIONS	Germinating annuals	trifluralin (TREFLAN 4 EC)	$\frac{1}{2}$ - 1	$\frac{1}{2}$ - 1 qt	Apply and incorporate before planting.
	Germinating annuals	diphenamid (ENIDE 90 W)	3 - 5	3 $\frac{1}{2}$ - 5 $\frac{1}{2}$ lb	Apply after seeding. Use higher rate on heavier soil. May reduce stands of fall seeded small grains.
	Germinating annuals	chlorpropham (FURLOE- CHLORO IPC) (4 E)	4 - 6	4 - 6 qt	Apply after planting until loop stage and again after 2 full true-leaf stage. Apply before or just as weeds emerge. Do not use on soils with less than 4% organic matter. Good on purslane, chickweed, smartweed. 30-day harvest restriction.
ONIONS (Mineral soil)	Emerged broadleaves	oxyfluorfen (GOAL 1.6 E)	$\frac{1}{16}$ - $\frac{1}{8}$	5 - 10 fl oz	Apply as a broadcast spray in 20 - 40 gal water per acre. Apply after onions have at least 2 expanded true leaves. Spray during sunny, warm weather. Do not apply more than $\frac{1}{2}$ lb a.i. (30 fl oz) total per acre per year. Do not apply after bulbings begins, or within 60 days of harvest.
	Perennials	bromoxynil (BROMINAL ME 4)	$\frac{1}{4}$ - $\frac{1}{2}$	8 - 12 fl oz	Use for control of wild mustards, shepherdspurse, and other cruciferous weeds. Follow label precautions carefully or onions may be injured.
GREEN ONIONS	Germinating annuals	glyphosate (ROUNDUP) (3 lb/gal)	1 $\frac{1}{2}$ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
	Germinating annuals	DCPA (DACTHAL) (75 WP)	6 - 10	8 - 14 lb	Can be used on seed, sets, or transplants. Apply immediately after planting or after a clean cultivation. Use higher rate on heavier, darker soils.
PARSLEY	Emerged annuals	DCPA (DACTHAL 75 WP)	6 - 10	8 - 14 lb	Apply immediately after seeding or after a clean cultivation. Use high rate on heavier soils.
PARSNIPS	Emerged annuals	stoddard solvent	40 - 60 gallons		Apply after 2 true leaves have formed.
	Germinating annuals	linuron (LOROX) (4 L)	1 - 2	1 - 2 qt	Apply before parsnips emerge and again after they are 4 inches high. Apply when weeds are less than 2 inches high. Do not apply when temperatures exceed 85° F. Do not apply at pressure greater than 40 psi. Do not apply within 2 days of stoddard solvent.

Emerged annuals	stoddard solvent (several trade names)	40 - 60 gallons	Apply after 2 true leaves are formed. Do not apply within 14 days after Lorox application.
<b>PEAS</b>			
Quackgrass	glyphosate (ROUNDUP) (3 lb./gal)	1½	2 qt
Germinating grasses and some broadleaves	trifluralin (TREFLAN 4 EC)	½ - ¾	½ - ¾ qt
	metolachlor (DUAL 8 E)	1½ - 3	¾ - 1½ qt
	oryzalin (SURFLAN AS) (4 lb./gal) plus trifluralin (TREFLAN 4 EC)	¾	¾ qt
	propachlor (RAMROD 4 L)	3 - 4	3 - 4 qt
Emerged annuals	dinoseb (PREMERGE) (3 lb./gal)	1 - 2	1½ - 2½ qt
	paraquat (PARAQUAT PLUS)	½ - 1	1 - 2 qt
Canada thistle and emerged annuals	MCPB (CAN-TROL, THISTROL) (2 lb./gal)	¾ - 1	1 - 2 qt
Emerged annuals, yellow nutsedge, Canada thistle	bentazon (BASAGRAN) (4 lb./gal)	¾ - 1	¾ - 1 qt
Germinating annuals	metolachlor (DUAL) (8 E)	1½ - 3	¾ - 1½ qt
	trifluralin (TREFLAN 4 EC)	¾ - 1	¾ - 1 qt
Emerged annuals, yellow nutsedge, Canada thistle	bentazon (BASAGRAN) (4 lb./gal)	¾ - 1	¾ - 1 qt
Germinating annuals	diphenamid (ENIDE 90 W)	5	5½ lb
<b>PEPPERS</b> (Seeded)			
			Apply before peppers and weeds emerge. Irrigate after application if soil is dry.

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Amount of Commercial Formulation/Acre	Remarks and Limitations
<b>PEPPERS</b> (Transplanted)	Germinating annuals	napropamide (DEVRINOL) (50 WP)	1 - 2	2 - 4 lb	Apply before planting. Incorporate into soil 1 to 2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils. Carry over the following year may affect sensitive crops.
		diphenamid (ENIDE 90 WP)	5	5½ lb	Apply after transplanting and before weeds emerge. Irrigate after application if soil is dry.
		napropamide (DEVRINOL) (50 WP)	1 - 2	2 - 4 lb	Apply before planting. Incorporate into soil 1 to 2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils. Carry over the following year may affect sensitive crops.
		trifluralin (TREFLAN 4 EC)	½ - 1	½ - 1 qt	Apply before transplanting. Incorporate into soil 2 to 3 inches soon after application. Use lower rate on sandy soils.
	Germinating broadleaves	chloramben (AMIBEN-GRANULAR) (10 G)	2-4	20 - 40 lb	Apply 3 to 5 days after transplanting and before weed emergence, or later in the season after a cultivation. Use granular formulation only. Controls ragweed, smartweed, and nightshade. Use lowest rate on sandy soils.
<b>POTATOES</b>	Quackgrass	dalapon (DOWPON M) (85% salt)	10	13½ lb	Apply in spring when quackgrass is 4 to 6 inches tall. Wait 1 week before plowing. Use 30 to 40 gal water/acre.
	Germinating annual grasses and broadleaves	EPTC (EPTAM) (7 lb/gal)	4 - 6	2¼ - 3¼ qt	Apply and incorporate immediately to a depth of 2 to 3 inches. Use higher rate for nutsedge control. May stunt Superior variety. EPTC should be followed by linuron, metribuzin, or dinoseb after weeds emerge but before potatoes emerge.
		metolachlor (DUAL) (8 E)	1½ - 3	¾ - 1½ qt	Use lower rate on light, sandy soils with less than 3% organic matter. May be incorporated to 3 inches before planting, applied preemergence after planting, or incorporated after planting before potatoes emerge. Cool, wet soil conditions after application may delay maturity or reduce yields of early maturing varieties.
	Germinating and emerged broadleaves and some grasses	linuron (LOROX 4 L)	1	1 qt	Apply to emerged weeds before potatoes emerge. Apply after field leveling.
		metribuzin (SENCOR 4 F, LEXONE 4 F)	½ - 1	½ - 1 qt	Apply on weeds up to 1 inch high, before potatoes emerge. Use higher rate on muck soils. Apply after field leveling.
		dinoseb (PREMERGE) (3 lb/gal)	3	4 qt	Apply 2 to 4 days before potatoes emerge.
	Emerged annual broadleaves	metribuzin (SENCOR, LEXONE) (4 F)	¾	8 fl oz	Apply post-emergence over the top of potatoes. Avoid spraying during the 12 to 15 inch stage to avoid injury. Do not apply after 3 cool, cloudy days. Do not use on early maturing or red skin varieties. Do not apply within 1 day of other pesticides. Do not apply more than 1 lb a.i. metribuzin/acre/year. May cause injury to sensitive crops the following year. 60 day harvest restriction.

Perennials	glyphosate (ROUNDUP) (3 lb/gal)	1½ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>RHUBARB</b>	paraquat (PARAQUAT PLUS) (2 lb/gal)	½ - 1	1 - 2 qt	For use on dormant rhubarb, use higher rate for heavier weed infestation. Do not exceed 2 applications per season. Gives some suppression of quackgrass.
<b>RUTABAGA, TURNIP</b>	DCPA (DACTHAL 75 WP)	8	11 lb	Apply before crop and weeds emerge. If soil is dry, irrigate lightly after application.
<b>SPINACH</b>	diethyl-ethyl (ANTOR 4 ES)	3 - 4	3 - 4 qt	Apply and incorporate 1-2 inches before seeding, or apply preemergence after seeding to moist soil. Needs rain or irrigation for activation.
	chlorpropham (FURLOE-CIPC 4 E)	1 - 2	1 - 2 qt	Apply immediately after planting. Use lower rate when temperatures are below 60° F.
Perennials	glyphosate (ROUNDUP) (3 lb/gal)	1½ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>SQUASH, PUMPKINS</b>	paraquat (PARAQUAT PLUS)	½ - 1	1 - 2 qt	Apply before or after seeding but before crop emergence. Include a non-ionic surfactant.
Germinating annuals	chloramben (AMIBEN DS) (75% DS)	2	2½ lb	Apply before crop or weeds emerge. If soil is dry, irrigate after application.
	propachlor (RAMROD 4L)	4 - 6	4 - 6 qt	Apply after seeding but before weeds emerge. Use high rate on heavier soils. Use only on pumpkins for processing.
<b>STRAWBERRIES</b> (New and established plantings)	diphenamid (ENIDE) (90 W)	4 - 6	4½ - 6½ lb	Apply about 5 days after planting and before weeds emerge; in spring or fall on established fields. Do not use on new plantings on sandy soil. Do not apply within 60 days of harvest. Controls seedling grains if applied prior to mulching.
	DCPA (DACTHAL) (75 WP)	6 - 8	8 - 11 lb	Apply about 5 days after planting and before weeds emerge; in spring on established fields. Particularly effective on sandy soils. Do not apply after first bloom.
Germinating annuals	napropamide (DEVRIKOL) (50 WP)	1 - 2	2 - 4 lb	Apply before weeds emerge in spring, fall or following cultivation. May inhibit runner rooting on extremely light sandy soils. Must be irrigated in or incorporated into the soil 2 inches deep prior to planting.
Germinating and emerged broadleaves	chloroxuron (TENORAN) (50 WP)	4	8 lb	Apply after transplanting and before weeds are 2 inches high; apply in fall or spring on established fields. Do not apply within 60 days of harvest. Do not apply more than twice in a season.
Emerged annuals	paraquat (PARAQUAT PLUS)	½	1 qt	Apply as a directed spray, using shields to protect strawberry plants. Do not allow spray to contact strawberry plants. Do not apply within 21 days of harvest.
<b>STRAWBERRIES</b> (Established plantings)	2,4-D (FORMULA 40) (4 lb/gal)	1	1 qt	Apply after harvest at renovation time. Do not apply after August 1 or misshapen fruit may be produced the next season.

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Amount of Commercial Formulation/Acre	Remarks and Limitations
	Emerged and germinating annuals	terbacil (SINBAR) (80 WP)	¼ - ½	5 - 12 oz	Apply at renovation (after mowing) or in late fall. Use the lowest rate on sandy soils. Do not use on the "Guardian" variety. Check the label for crops that can be planted after strawberries.
<b>SWEET CORN</b>	Germinating broadleaves	atrazine (several trade names) (80 WP)	1	1¼ lb	Apply after planting and before weeds are 1 inch high. Observe label warnings on crop rotations.
	Germinating annuals	atrazine (several trade names) (80 WP) plus alachlor (LASSO 4 EC)	1 plus 2	1¼ lb plus 2 qt	Apply before crop or weeds emerge. Observe label warnings on crop rotations.
		cyazazine (BLADEX 4 L) plus alachlor (LASSO 4 EC) or metolachlor (DUAL 8 E)	.6 - 2 plus 2 - 2½ or 1 - 2½	.6 - 2 qt 2 - 2½ qt ½ - 1¼ qt	Apply after planting and before weeds emerge. Use highest rates on soils with 4% or more organic matter. Bladex is not very effective on muck soil. If used at correct rates, there should be no herbicide carry-over the following year. Rainfall or irrigation (½ inch) after application will improve weed control.
	Emerged broadleaves	metolachlor (DUAL) (8 E) 2,4-D amine salts (several trade names)	1½ - 3 ½	¾ - 1½ qt ¾	Use lower rate on sandy soils with less than 3% organic matter. Incorporate 1 to 2 inches before planting, or apply preemergence after planting. Spray after corn and weeds emerge and before corn is 8 inches tall. Avoid drift onto sensitive crops.
	Quackgrass	atrazine (80 WP) glyphosate (ROUNDUP) (3 lb/gal)	3 - 4 1½	4 - 5 lb 2 qt	Apply before corn emerges. Do not plant crops other than corn the following year. Apply to 8-inch quackgrass in the fall or spring before planting. Wait at least 5 days prior to plowing.
	Nutsedge	EPTC (ERADICANE EXTRA 6-E) butylate (SUTAN +) (6.7 E) alachlor (LASSO 4 EC) EPTC (ERADICANE 6.7 E)	6 4 3 4	4 qt 2½ qt 3 qt 2½ qt	Incorporate immediately after application. Do not use on soils with more than 10% organic matter. Suppresses emergence of quackgrass and nutsedge. Apply before planting. Incorporate into soil 2 to 3 inches after spraying. Also controls annual grasses. Apply before corn emerges. If soil is dry, shallow incorporation may increase effectiveness. Apply before planting. Incorporate into soil 2 to 3 inches after spraying. Also controls annual grasses.

Nutsedge, Canada thistle, other broadleaves	bentazon (BASAGRAN) (4 lb./gal)	$\frac{3}{4}$ - 1	$\frac{3}{4}$ - 1 qt	Treat nutsedge at 4 to 6 inches, and again 10 days later. Apply to broadleaves when they are small and actively growing. Always add 1 qt crop oil concentrate per acre to the spray mix.
<b>SWEET POTATOES</b>				
Germinating annuals	diphenamid (ENIDE 90 W)	5	5½ lb	Apply after transplanting, but before weeds emerge.
Perennials	oryzalin (SURFLAN AS) (4 lb./gal)	$\frac{3}{4}$ - 1	$\frac{3}{4}$ - 1 qt	Apply after transplanting, but before weeds emerge. Use lower rate on light soils.
	glyphosate (ROUNDUP) (3 lb./gal)	1½ - 2	2 - 3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Check label for best time of year, stage of growth, and rate for each problem perennial weed.
<b>TOMATOES (Seeded)</b>				
Emerged annuals	paraquat (PARAQUAT PLUS)	$\frac{3}{8}$ - 1	1 - 2 qt	Apply before or after seeding but before crop emergence. Include a non-ionic surfactant.
Germinating annuals	diphenamid (ENIDE 90 W)	5	5½ lb	Apply before tomatoes or weeds emerge. If soil is dry, irrigate after application.
Germinating or emerged broadleaves	napropamide (DEVRINOL) (50 WP)	1 - 2	2 - 4 lb	Apply before planting. Incorporate into soil 1 to 2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils. Carry-over may affect corn, small grains, alfalfa, lettuce, sugar beets.
	metribuzin (SENCOR, LEXONE) (4 F)	$\frac{3}{4}$	8 fl oz	Apply as a directed or broadcast spray after tomatoes have 5 to 6 leaves. Apply after 3 sunny, warm days. Do not apply within 1 day of application of other pesticides. Do not tank mix with other pesticides. Multiple applications can be made with a minimum of 14 days between applications. Up to 1 lb a.i./acre can be applied as a directed spray. (Avoid contact with tomato foliage.) 7 days harvest restriction. Do not apply more than 1 lb a.i./acre/year.
Germinating nightshade, ragweed, smartweed	chloramben (AMIBEN DS) (75% DS)	2 - 3	2½ - 4 lb	Use only with a vermiculite anticrustant and activated carbon seed protection system. After seeding with the anticrustant, broadcast Amiben in 10 - 40 gal water per acre. Some weeds will germinate in the row.
Nutsedge	chloramben (AMIBEN GRANULAR) (10 G)	3 - 4	30 - 40 lb	Apply after the last cultivation to weed-free soil. Apply when tomato foliage is dry. Use granular formulation only.
	pebulate (TILLAM 6 E)	4 - 6	2½ - 4 qt	Apply as a directed spray to clean cultivated soil and incorporate or irrigate in.
<b>TOMATOES (Transplanted)</b>				
Germinating annuals	napropamide (DEVRINOL) (50 WP)	1 - 2	2 - 4 lb	Apply before planting. Incorporate into soil 1 to 2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils. Carry-over may affect corn, small grains, alfalfa, lettuce, sugar beets.
	trifluralin (TREFLAN 4 EC)	$\frac{3}{8}$ - 1	$\frac{3}{8}$ - 1 qt	Apply before transplanting. Incorporate into soil 2 to 3 inches soon after application. Use lowest rate on sandy soils.
	diphenamid (ENIDE 90 W)	4 - 6	4½ - 6½ lb	Apply after transplanting and before weeds emerge.

Crop	Weed Problem	Chemical	Pounds Active Ingredient/Acre	Amount of Commercial Formulation/Acre	Remarks and Limitations
	Germinating nightshade, ragweed, smartweed	chloramben (AMIBEN GRANULAR) (10 G)	3 - 4	30 - 40 lb	Apply 3 to 5 days after transplanting and before weed emergence or later in the season after a cultivation. Use granular formulations only. Effective on ragweed, smartweed, and nightshade. Use lowest rate on sandy soils.
	Germinating and emerged broadleaves	metribuzin (SENCOR, LEXONE) (4 F)	$\frac{1}{2}$	8 fl oz	Apply after transplants have started growth and before weeds are 2 inches tall. Repeat as necessary. Apply after 3 sunny, warm days. Do not apply within 1 day of application of other pesticides. Do not tank mix with other pesticides. Do not apply more than 1 lb a.i./acre/year. Do not use hotcaps on treated plants within 7 days of application.
	Nutsedge	pebulate (TILLAM 6 E)	4 - 6	2 $\frac{1}{2}$ - 4 qt	Apply and incorporate to a depth of 2 to 3 inches before planting. Use lower rate on light colored soils with less than 2% organic matter.
<b>WATERMELONS Emerged (Transplanted) annuals</b>					
	Germinating broadleaves	paraquat (PARAQUAT PLUS)	$\frac{1}{2}$ - 1	1 - 2 qt	Apply before planting to kill emerged weeds. Include a non-ionic surfactant.
	Germinating broadleaves	naptalam (ALANAP) (2 lb/gal)	4	8 qt	Apply before or after transplanting and before weeds emerge. If soil is dry, irrigate after application. When grasses are a problem, use with PREFAR before planting.
	Germinating grasses	bensulide (PREFAR 4 E)	6	6 qt	Apply before transplanting. Irrigate or incorporate into soil 2 to 3 inches immediately after spraying.
	Germinating broadleaves and grasses	naptalam (ALANAP) (2 lb/gal) plus dinoseb (PREMERGE) (3 lb/gal)	4 plus 2	8 qt plus 3 qt	Apply before transplanting. Can be utilized under clear plastic mulch. Wait 5 days before transplanting.
<b>NON-CROP LAND</b>					
	Bare ground-long term control of annual and perennial weeds	atrazine (several trade names) (80 WP) diuron (several trade names) (80 WP) simazine (several trade names) (80 WP)	10 - 20 15 - 20 10 - 20	12 - 25 lb 19 - 25 lb 12 - 25 lb	For use around buildings, storage areas, fence rows, etc. Use higher rate for hard-to-control perennials. Addition of sodium chlorate will improve control of field bindweed, goldenrod, and milkweed. Same as above. Same as above.
		hexazinone (VELPAR) (90% SP)	2 - 4%	2 - 5 lb	Use higher rate on hard to kill weeds, clay soils, or soils containing more than 5% organic matter. Apply before or soon after weed emergence. Will injure or kill woody perennials, so should not be used around shade trees or ornamentals.



bromacil (HYVAR X) (80 WP)	2½ - 9	3 - 12 lb	Use lower rate for control of annuals, higher rate for control of perennials. Bromacil is quite soluble in water, and may move in run off water to non-target areas. Therefore, do not use in or near turf, ornamentals, or other plants of value.
dalapon (DOWPON M) (85% salt)	8½ - 17	10 - 20 lb	Apply after flowers have formed.
Perennial broadleaves and grasses			
glyphosate (ROUNDUP) (3 lb/gal)	1½ - 3	2 - 4 qt	Apply to actively growing foliage. Check label for most susceptible stage of target weed. Include a non-ionic surfactant.
amitrole (AMINO TRIAZOLE) (90% SP)	2 - 3½	2 - 4 lb	Kills most herbaceous broadleaves and grasses. Use higher rate to control tough perennials such as Canada thistle, milkweed, quackgrass. Use 10 lb for cattail control. Apply to actively growing foliage. Avoid contact or drift to non-target plants, as it will injure ornamentals and shrubs.
Emerged annuals			
paraquat (PARAQUAT PLUS) (2 lb/gal)	½	1 qt	Apply to actively growing foliage. Include a non-ionic surfactant. Can be used in combination with residual materials.
Annual broadleaves			
2,4-D (several trade names and formulations)	1½ - 3		Apply to actively growing foliage. Use amine or low-volatile ester formulations. Check label for amount of product per acre.
Annual and perennial broadleaves			
dicamba (BANVEL) (4 lb/gal)	¾ - 2	¾ - 2 qt	Controls many annual and perennial herbaceous weeds. Check label for rate for specific weeds. Avoid drift to non-target areas.
Brush control			
dicamba (BANVEL) (4 lb/gal) plus 2,4-D			Apply 2-4 lb dicamba plus 4 lb 2,4-D amine or low-volatile ester in 100 gal water. Thoroughly wet leaves and branches of target brush. Brush is most easily controlled during late spring and early summer.
hexazinone (VELPAR GRIDBALL) (10% pellets)	1 - 2	10 - 20 lb	Velpar Gridball pellets are scattered on the soil surface and allowed to dissolve in rain. Kills most brush and tree species. Space pellets uniformly for best results. Follow label carefully to avoid damage to shade or ornamental trees.
triclopyr (GARLON) (4 lb/gal)	1 - 8	1 - 8 qt	Use higher rates for hard to kill tree and brush species. Thoroughly wet leaves and bark of brush. Do not exceed 40 psi pressure. Avoid contact with non-target species.
fosamine (KRENITE) (4 lb/gal)	6 - 12	6 - 12 qt	Apply to brush in late summer or early fall. Response will be seen the following year. Thoroughly wet brush but do not spray to run off. Apply in 50 to 300 gal/acre. Avoid contact with non-target plants.

# Names, Sources, and Formulations of Herbicides Used on Vegetable Crops.<sup>1</sup>

Common Name	Trade Name <sup>2</sup> and Manufacturer	Concentration and Commercial Formulations <sup>3</sup>	Common Name	Trade Name <sup>2</sup> and Manufacturer	Concentration and Commercial Formulations <sup>3</sup>
alachlor	LASSO (Monsanto)	4 lb/gal L	hexazinone	VELPAR (DuPont)	90% SP; 2 lb/gal L
atrazine	SEVERAL (Various)	80% WP; 4 lb/gal L	linuron	LOROX (DuPont)	50% WP, 4 lb/gal L
benefin	BALAN (Elanco)	1.5 lb/gal L	MCPB	CAN-TROL (Rhône-Poulenc)	2 lb/gal L
bensulide	PREFAR (Stauffer)	4 lb/gal L	metolachlor	THISTROL (Union Carbide)	8 lb/gal L
bentazon	BASAGRAN (BASF)	4 lb/gal L	metribuzin	LEXONE (DuPont)	50% WP; 75% DF; 4 L
bromacil	HYVAR X (DuPont)	80% WP	napropamide	SENCOR (Mobay)	50% WP; 75% DF; 4 L
bromoxynil	BROMINAL (Union Carbide)	4 lb/gal L	naptalam	DEVRIKOL (Stauffer)	50% WP; 2 lb/gal L
butylate	SUTAN + (Stauffer)	6.7 lb/gal L	oryzalin	ALANAP (Uniroyal)	2 lb/gal L
chloramben	AMIBEN (Union Carbide)	2 lb/gal L; 10% G	oxyfluorfen	SURFLAN (Elanco)	2 lb/gal L; 75% WP
chloroxuron	TENORAN (Ciba-Geigy)	50% WP	paraquat	GOAL (Rohm and Haas)	1.6 lb/gal L
chlorpropham	FURLOE-CHLORO IPC (PPG)	4 lb/gal L	pendimethalin	PARAQUAT PLUS (Chevron)	2 lb/gal L
cyanazine	BLADEX (Shell)	80% WP, 4 L	phenmedipham	GRAMOXONE (ICI)	4 lb/gal L
cycloate	RO-NEET (Stauffer)	6 lb/gal L	prometryn	PROWL (Amer. Cyanamid)	1.3 lb/gal L
dalapon	DOWPON (Vertac)	85% salt	pronamide	SPIN-AID (Nor-Am)	80% WP, 4 lb/gal L
DCPA	DACTHAL (SDS)	75% WP	propachlor	CAPAROL (Ciba-Geigy)	50% WP
diethyl-ethyl	ANTOR (NOR-AM)	4 lb/gal L	pyrazon	KERB (Rohm & Haas)	4 lb/gal L
dinoseb	PREMERGE (Vertac)	3 lb/gal L	sethoxydim	RAMROD (Monsanto)	75.5% WP
diphenamid	ENIDE (NOR-AM)	90% WP	simazine	PYRAMIN RB (BASF)	1.53 lb/gal L
diuron	KARMEX (DuPont)	80% WP	stoddard solv.	POAST (BASF)	80% WP
EPTC	EPTAM (Stauffer)	7 lb/gal L	terbacil	PRINCEP (Ciba-Geigy)	100% oil
ethalfuralin	ERADICANE (Stauffer)	6.7 lb/gal L	trifluralin	SEVERAL (Various)	80% WP
fluzifop-butyl	SONALAN (Elanco)	3 lb/gal L	2,4-D	SINBAR (DuPont)	4 lb/gal L
glyphosate	FUSILADE 2000 (ICI)	1 lb/gal L		TREFLAN (Elanco)	
	ROUNDUP (Monsanto)	3 lb/gal L		SEVERAL (Various)	

<sup>1</sup>Trade names and formulations of herbicides are given for the convenience of the users. Other formulations of the same herbicides, or other herbicides with the same active ingredients may also be labeled for use on certain crops.

<sup>2</sup>"SEVERAL" means there are several trade names for the chemical. The mention of trade names does not imply that they are endorsed or recommended over those of similar nature not listed.

<sup>3</sup>ae — acid equivalent, ai — active ingredient, DF — dry flowable, DS — dry soluble, E or EC — emulsifiable concentrate, ES — emulsifiable solution, F or FL — flowable, G — granular, L — liquid, S or SP — soluble powder, w or WP — wettable powder.

# Effectiveness of Herbicides on Weeds<sup>1</sup>

**Know Your Weed Species!** — All herbicides have their strengths and weaknesses. Knowing what weeds are in your field will help you choose the most effective chemical among those registered for your crop.

HERBICIDE (TRADE NAMES)	REDBOOT PLGWEED	COMMON LAMBQUARTER	GALINSOGA	MUSTARDS	NIGHTSHADE	COMMON PURSLANE	COMMON RAGWEED	SMARTWEED	CRABGRASS	FOXTAILS	BARNYARD- GRASS	FALL PANICUM	STINKGRASS	QUACKGRASS	YELLOW NUTSEDGE
<b>Preplant Incorporated Herbicides</b>															
BALAN	G	F	P	P	P	P	P	P	E	E	E	E	E	P	P
DEVINOL	G	P	P	P	P	P	P	P	E	E	E	E	E	P	P
DUAL	G	F	G	P	G	F	P	F	E	E	E	E	E	P	F
EPTAM	C	G	F	F	F	F	F	F	E	E	E	E	E	G	G
PREFAR	G	P	P	P	P	P	P	P	E	E	E	E	E	P	P
RO-NEET	G	F	F	P	P	F	P	F	E	E	E	F	E	P	F
SUTAN +	F	P	F	P	P	P	P	P	E	E	E	E	E	P	G
TILLAM	F	F	F	P	P	P	P	P	E	E	E	F	F	P	G
TREFLAN	G	F	P	P	P	F	P	P	E	E	E	E	E	P	P

HERBICIDE (TRADE NAMES)	REDBOOT PLGWEED	COMMON LAMBQUARTER	GALINSOGA	MUSTARDS	NIGHTSHADE	COMMON PURSLANE	COMMON RAGWEED	SMARTWEED	CRABGRASS	FOXTAILS	BARNYARD- GRASS	FALL PANICUM	STINKGRASS	QUACKGRASS	YELLOW NUTSEDGE
<b>Herbicides with Postemergence Activity</b>															
AATREX	E	E	G	G	G	E	E	G	F	E	G	F	E	P	P
BASAGRAN	P	G	G	G	G	E	E	G	F	P	P	P	P	P	P
BLADEX	F	G	G	G	G	G	G	G	G	G	G	G	G	P	P
BROMINAL	F	E	G	G	G	G	E	E	P	P	P	P	P	P	P
CAPAROL	E	E	G	G	G	E	F	F	F	F	F	F	F	P	P
DOWPON	P	P	P	P	P	P	P	P	F	F	G	G	G	P	P
FORMULA 40	E	E	G	G	E	P	E	P	P	P	P	P	P	P	P
GOAL	E	F	G	G	E	G	G	F	F	F	F	F	G	P	P
LEXONE, SENCOR	G	E	E	E	P	E	E	E	F	G	F	F	F	P	P
LOROX	E	E	G	G	E	E	E	P	P	F	F	F	F	P	P
PARQUAT	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E <sup>2</sup>
ROUNDUP	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F
SPIN-AID	P	G	G	G	F	G	G	G	P	P	P	P	P	P	P
STODDARD SOLVENT	E	E	F	E	E	E	P	E	E	E	E	E	E	F	F
TENORAN	E	G	G	E	G	G	F	F	F	F	F	F	F	P	P

HERBICIDE (TRADE NAMES)	REDBOOT PLGWEED	COMMON LAMBQUARTER	GALINSOGA	MUSTARDS	NIGHTSHADE	COMMON PURSLANE	COMMON RAGWEED	SMARTWEED	CRABGRASS	FOXTAILS	BARNYARD- GRASS	FALL PANICUM	STINKGRASS	QUACKGRASS	YELLOW NUTSEDGE
<b>Preemergence Surface-Applied Herbicides</b>															
AATREX	E	E	G	E	E	E	E	G	G	G	P	P	G	G	G
ALANAP	G	G	F	F	F	F	F	G	P	P	P	P	P	P	P
AMIBEN	E	E	F	F	G	G	G	F	F	F	F	F	F	P	P
ANTOR	G	F	G	F	G	F	F	G	G	G	G	G	G	P	P
BLADEX	F	E	G	G	E	E	E	G	G	G	F	F	F	P	P
CAPAROL	E	E	F	G	G	E	E	G	F	F	F	F	F	P	P
DACTHAL	F	F	G	P	P	P	P	P	E	E	E	G	E	P	P
DUAL	G	F	G	P	G	F	F	F	E	E	E	E	E	P	F
ENIDE	G	F	P	P	P	G	P	F	E	E	E	E	E	P	P
FURLOE CHLORO IPC	F	F	P	P	P	G	P	E	F	F	F	F	F	P	P
KARMEX	E	E	G	G	E	E	E	E	F	E	E	F	E	P	P
KERB	P	F	P	P	P	G	F	F	F	F	F	F	F	G	P
LASSO	E	F	G	P	G	G	F	F	E	E	E	E	E	P	F
LEXONE, SENCOR	G	E	E	E	P	E	E	E	F	G	G	G	G	P	P

<sup>1</sup>Assuming that the chemicals are applied at the proper time and at the appropriate rate for each soil type. This information is based on performance of these chemicals in vegetable crops. E = Excellent, G = Good, F = Fair, P = Poor  
<sup>2</sup>Kill of top growth only.

# GENERAL PESTICIDE INFORMATION AND REFERRALS

County Cooperative Extension Service Office ( ) -

## Integrated Pest Management Programs

Michigan State University  
East Lansing, MI 48824 (517) 355-0117

## Center for Environmental Toxicology

Michigan State University  
East Lansing, MI 48824 (517) 353-6469

## Plant Industry Division

Michigan Department of Agriculture  
Lansing, MI 48909 (517) 373-1087

## Office of Hazardous Waste Management

Michigan Department of Natural Resources  
Lansing, MI 48909 (517) 373-2730

## Center for Environmental Health Sciences

Michigan Department of Public Health  
Lansing, MI 48909 (517) 373-8050

## PESTICIDE EMERGENCY INFORMATION

### Human Pesticide Poisoning

(within Detroit City proper)

(313) 494-5711

(within the 313 area code)

(800) 462-6642

(statewide)

(800) 572-1655

Poison Control Center

Children's Hospital of Michigan

3901 Beaubien

Detroit, MI 48201

(within Grand Rapids City proper)

(616) 774-7854

(within the 616 area code)

(800) 442-4571

(statewide)

(800) 632-2727

Blodgett Regional Poison Center

Blodgett Memorial Medical Center

1840 Wealthy, S.E.

Grand Rapids, MI 49506

(within Marquette City proper)

(906) 228-9440

(Upper Peninsula only)

(800) 562-9781

U.P. Poison Control Center

Marquette General Hospital

420 West Magnetic Street

Marquette, MI 49855

### Animal Pesticide Poisoning

Your Personal Veterinarian

( ) -

and

Animal Health Diagnostic Laboratory

Michigan State University

East Lansing, MI 48824

(517) 353-1683

### Pesticide Product Involved in a Fire

Local Fire Department

( ) -

and

Fire Marshal Division, State Police

(517) 322-1924

### Pesticide Product Involved in a Traffic Accident

Local Police Department, Sheriff's Office, or State Police

( ) -

and

Motor Carrier Division, State Police

(517) 373-3700

### Pesticide Pollution Accident in the Environment

Pollution Emergency Alerting System

Michigan Department of Natural Resources

3500 N. Logan

Lansing, MI 48909

(800) 292-4706