EXTENSION BULLETIN 433
Farm Science Series

FEBRUARY, 1971
1871.1

CHEMICAL WEED CONTROL for Horticultural Crops

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WEEDS REDUCE CROP VALUES in the United States an estimated 4 to 5 billion dollars each year, more than the losses caused by diseases and insects combined. Weeds compete with crop plants for water, nutrients and light. They also harbor insects and diseases, and generally reduce yields and crop quality.

Some Basic Principles

Weeds are killed most easily when conditions favor germination of weed-seed and rapid plant growth. Under these conditions, crop plants are also most easily injured. The chemicals recommended, however, are designed to kill weeds without serious injury to the crop (selective weed control), under conditions favorable for plant growth. Poor results from pre-emergence sprays often are due to the lack of enough soil moisture after spraying to activate the chemicals or to bring about weed-seed germination in the surface soil.

Chemicals recommended for selective weed control kill best when weed seeds are germinating or when plants are young. With a few exceptions, chemicals used at the recommended rates will not kill older plants.

Know your weed species. This is important because several chemicals are effective on certain species only. For instance, at the recommended rates, CHLORO IPC will kill purslane, chickweed, and smartweed, but not lambsquarter or pigweed. If only these last two are present, CHLORO IPC will appear ineffective.

Use Chemicals Safely

Handle herbicides carefully. Herbicides, like other pesticides should be handled with extreme caution. Many pesticide accidents occur when the operator is filling the spray tank. Although the greatest health hazard is considered to be ingestion of these chemicals by mouth, there is also danger of irritation to skin and eyes. Rubber gloves and goggles should be worn when handling herbicides. Avoid breathing vapors of these chemicals. Weed killers and fumigants in this bulletin which require considerable caution in handling are:

AMS (Ammate-X)
CDAA (Randox)
Dinoseb (Sinox PE, Premerge)
Methyl Bromide + Chloropicrin (MC-33)
Mylone
Paraquat (Dual Paraquat or Paraquat CL)
Propachlor (Ramrod)
Metham (Vapam)

In case of accidental exposure to these chemicals, consult a physician immediately, and if possible, bring a label which identifies the chemical you are using.

Use the recommended rate of application. The selectivity of chemicals for crop plants (killing weeds

and not the crop) occurs only when the amount of chemicals applied falls within certain ranges. The greater the range of tolerance of a crop plant, the better the chemical is for weed control, provided the chemical will kill weeds throughout this range. No crop plant is completely resistant to herbicide injury.

Rates differ with soil type. In general, use the lower recommended rates on light or sandy soils and higher rates on silt and clay loams or heavier soils.

Know the chemical's limitations. These appear on the product label. Read it carefully. Following is the type of information given on labels.

"TREFLAN will not control certain resistant weeds such as cocklebur, velvetleaf, jimsonweed, ragweed, Venice mallow and nutgrass."

"Some moisture either as rain or irrigation is required soon after application to activate RAMROD 65. On light sandy loam soil one-third inch of rainfall and on heavy clay and/or high organic soils one-third to three-fourths inch of rainfall is required depending upon original soil moisture. Best results are obtained when moisture occurs within 10 days after application. Generally lower amounts of rainfall are required where soil moisture is high at time of planting."

Be careful of wind drift and volatility. Use only low-volatile forms of 2,4-D on vegetable and fruit farms. Be careful not to spray herbicides near sensitive crops such as grapes and tomatoes. Spray with 2,4-D only on quiet days to avoid drift onto sensitive crops. Use low pressure (20 psi or less) and keep nozzles as close to soil level as possible.

Possible Problems or "Side Effects"

Annual Crops (vegetables and flowers) – If the suggested weed control practices are not followed carefully, there is the possibility of chemical residues causing damage to crops planted the next year. This may occur even if no injury occured to the crop being treated.

Perennial Crops (fruits and ornamentals) – Several years' tests indicate there is no danger of an excessive build-up in the soil of the chemicals suggested for use. However, when the perennial crop is removed, and an annual crop follows, care must be taken that a tolerant species is planted.

Carefully read the label for further details on these problems for individual chemicals.

Storage of Chemicals

The following storage practices may result in a longer storage life of herbicides or may decrease the danger of misuse or injury.

1. Keep herbicides and other pesticides under lock and key away from the reach of children and animals.
2. Store herbicides in a cool dry place. Liquid formulations should not be exposed to freezing temperatures as the emulsions may settle out.
3. Keep the materials in their original labeled containers and mark the year of purchase. Label information concerning uses and tolerances may change from year to year.
4. Fold the tops of bags over several times to keep out moisture. Keep the tops of bottles and cans firmly in place.
5. Do not store 2,4-D type herbicides with other pesticides as they may absorb the volatile 2,4-D and cause injury to plants.
6. Read labels for further storage instructions.

Disposal of Containers

A private disposal pit may be prepared for disposal of containers and excess material. It should be located a safe distance from homes, wells, streams, crops, and livestock. Level, well-drained soil is preferred as it will allow the residue to be absorbed through the soil and lessen the danger of run-off. As a general rule, herbicide containers should not be burned as the vapors may damage surrounding crops. Glass and metal containers should be broken and buried to a depth of at least 18 inches in the disposal pit. This practice also applies for surplus chemicals.

Cleaning Weed Control Sprayers

It is important to keep weed control sprayers clean. This is especially true if you use them to spray more than one crop or to apply fungicides and insecticides.

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

When cleaning a sprayer, thoroughly rinse the whole sprayer with water, inside and out, including boom, hoses and nozzles, both **before** and **after** cleaning. Partially fill the sprayer with water before you add the cleaning agent. Keep the pump running so that the cleaning solution will circulate throughout the sprayer. Do not leave corrosive cleaning agents in the tank or spray system more than 2 hours.

When you are using only pre-emergence sprays, a good rinsing with water is enough. For other spraying purposes, remove weed-killers from sprayers by adding 1 gallon of household ammonia or 5 pounds of sal soda to 100 gallons of water. Allow this solution to stand in the sprayer for **at least** 2 hours. Drain it out through the boom and nozzles, and rinse the sprayer with water. Do not let spray solutions stand in the tank overnight. Do not allow solutions to run into streams or other water sources.

Registration of Herbicides and Mixtures

Suggestions in this bulletin are based on data obtained from 2 or more years of trials. Use of these chemicals and methods, however, depends on registration of the products by the Environmental Protection Agency. Growers are warned not to use a chemical on a food crop for which the compound is not registered; to do so could lead to confiscation of the

crop if a residue is found on produce in either the fresh market or processed crop. Do not mix herbicides with other herbicides or pesticides unless compatibility and safety have been demonstrated. Herbicide combinations suggested in this bulletin are compatible and produce no increase in residues found in the crop.

Weed Sprayers

Many types of sprayers are suitable for chemical weed control. You do not need to buy expensive, high-gallonage, high-pressure spray equipment. A complete weed-control sprayer should have the following features:

1. A low pressure pump. It should be easily replaced, not subject to damage by wettable powders, and have minimum capacity of 9 gallons per minute.

2. Solution agitation (stirring). It can be either mechanical or a bypass from the pump. If a power takeoff sprayer does not provide agitation, add a bypass to a galvanized tee between the pump and pressure guage. To increase agitation in the tank, place an agitator nozzle on the end of the overflow hose. In this case, a separate valve on the bypass line will regulate pressure. If the pump does not have enough capacity for agitation under specific spraying conditions, provide it by using both the next lower tractor gear and nozzle tips with a smaller orifice.

3. 50-mesh screens for suction line and nozzles. Wettable powders will not go through the 100-mesh screens which are sometimes provided.

4. A spray boom. It should have nozzles adjustable for distance between nozzles on the boom and for height above the ground. This is especially important for band spraying.

5. A gauge to measure pressure accurately up to 100 pounds per square inch.

6. Flat fan nozzles. The best nozzle size for general use is equivalent to an 8004 Teejet. For most work, a wide-angle nozzle – 73 or 80 degrees – is best because the boom can be held close to the ground to reduce drift. This is most important when it is windy.

7. For tree fruit and nurseries, 110 degree angle nozzles. A rigid boom with three 110 degree angle nozzles located 2 feet apart and 14 inches above the ground will spray a strip 6 feet wide. The sprayed area can be reduced to 4 feet by plugging the inside nozzle or extended to 8 or more feet by making the boom proportionately longer and adding more nozzles.

For vineyards and nurseries a TOC nozzle placed on a gun or on the end of a boom may be used, if it can be held at a rigid 45-degree angle.

Sprayer Calibration

One of the most important factors in effective weed spraying is accurate calibration – determining the amount of spray material applied per acre. A range of 20 to 60 gallons per acre, at a pressure of 20 to 60 pounds per square inch, is satisfactory.

Adjust the boom height so that the spray overlaps about a third at ground level. For overall spraying, using 80 degree nozzles, this places the nozzles about 18 to 20 inches apart on the boom and 18 to 20 inches from the sprayed surface.

A good way to calibrate a sprayer is to:

1. Fill the spray tank with water only.
2. Spray a measured area, in a field if possible, at a fixed tractor speed and pressure gauge setting. Be sure to allow for partial coverage if bands are used.
3. Measure the amount of water needed to refill the tank.
4. Divide this amount by the fraction of an acre sprayed to get the gallons applied per acre.
5. Mix the amount of chemical desired per acre with water to give this much spray material.

For example, if 10 gallons were applied on one-fourth acre, the volume of spray material applied would be 40 gallons per acre. If you change the tractor speed or gear, pressure setting, nozzle size, or number of nozzles, the amount of liquid applied per acre will be different and recalibration will be necessary.

Band Application in Row Crops

Since weeds in the crop row are usually the hardest to control, it may cost only 50 percent as much to spray herbicides in a band over the row rather than to cover the whole area.

For band applications, adjust for the area actually sprayed and not for the total acres in the field. For example, suppose the recommendation for a chemical is 4 pounds per acre, and 12-inch strips are sprayed over 36-inch rows. Only one-third of the ground area will be covered with spray material, so only 1⅓ pounds of chemical (one-third of 4 pounds) will be required per acre. Four pounds of chemcal will then cover 3 acres of the crop.

To adjust the sprayer for band application, place the boom so that there is one nozzle over each row and plug the nozzles between rows. This is not always easy with standard booms, but you can buy adjustable booms or adapters.

Orchard, Vineyard and Nursery Application

Drive down the row in one direction; never go in a circle around the trees, since this concentrates the spray at the base of the tree.

Apply the spray as a complete row treatment or as squares under the orchard trees. It is usually best to spray a strip on one side of a row going in one direction and on the other side coming back. In vineyards, the entire band (under a row) may be sprayed with a 45-degree angle TOC nozzle on a gun or boom. The width of the band will be determined by the age of the plants and desires of the grower. Most orchard trees should have weeds controlled under the full spread of the branches. For young trees, vineyards and nurseries a 3-4 foot band in the row may be sufficient.

1971 SUGGESTIONS FOR CHEMICAL WEED CONTROL IN HORTICULTURAL CROPS

ALWAYS READ THE LABEL ON THE CONTAINER

NOTE: – Rates Given Are for Pounds of Active Ingredients per Acre Actually Covered with Spray Material unless otherwise specified. (Trade names, in capital letters are shown with the understanding that there is no discrimination and no indorsement by the Cooperative Extension Service implied.)

VEGETABLES

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Asparagus (Seedlings)	Germinating annuals	linuron (LOROX)	1	Before asparagus emerges and before weeds are 1 inch high.	Do not use on extremely sandy soils. Double rate for muck soils.
		chloramben (VEGIBEN)	2 to 3	Before asparagus and weeds emerge.	Use lowest rate on sandy soils. If soil is dry, irrigate after application.
Asparagus (year after transplanting)	Germinating annuals	monuron (TELVAR)	2 to 3	After disking in the Spring and again after the harvest season, if necessary. Apply before weeds emerge.	Total dosage not to exceed 6 lbs. per acre per year.
		simazine (PRINCEP)	2 to 4	Same as above	
	Quackgrass	dalapon (DOWPON, BASFAPON)	10	During or at the end of the harvest season when quackgrass is 4 to 6 inches high.	Spray made *during* the harvest season should be made immediately following harvesting. Two applications may be necessary for complete control. Do not spray fern.
	Emerged milkweed, field bindweed, anual broadleaves	2,4-D (Sodium salt form only)	2	During or after the harvest season when weeds are growing rapidly.	Spray made during the harvest season should be made immediately after a harvest to minimize injury. When spraying *after* the harvest season, use drop nozzles to avoid spraying fern.
Beans (Lima)	Germinating annuals	chloramben (VEGIBEN)	2 to 3	Before leaves or weeds emerge.	If soil is dry, irrigate after application.
		dinoseb (PREMERGE, SINOX PE)	3 to 6	Before beans emerge.	If possible apply when soil is moist.
	Germinating grasses and some broadleaves	trifluralin (TREFLAN)	½ to ¾	Before planting.	Incorporate into soil 2 to 3 inches immediately after spraying. Use lowest rate on sandy soils.
Beans (Snap)	Germinating annuals	EPTC (EPTAM)	3	Before planting.	Incorporate into soil 2 to 4 inches immediately after spraying.
		dinoseb (PREMERGE, SINOX PE)	3 to 6	Before emergence to crook stage on beans.	When applying at crook stage use lower rate of application. If possible apply when soil is moist.
	Germinating grasses and some broadleaves	trifluralin (TREFLAN)	½ to ¾	Before planting	Incorporate into soil 2 to 3 inches immediately after spraying. Use lowest rate on sandy soils. Does not control ragweed.
Beets (Table)	Germinating and emerged annuals	pyrazon (PYRAMIN)	4	From planting to before weeds are 2 inches high.	On muck soils, better control is often obtained by spraying small weeds after beets have two true leaves. Add crop oil at 1 gallon per 40 gallons of spray or a surfactant such as X-77 at 1 pint per 50 gallons of spray.
Broccoli, cabbage and cauliflower (seed beds or field seeded)	Germinating and emerged annuals	nitrofen (TOK)	2 to 4	Before crop emergence, and again after plants have 3 true leaves.	Use the 4 lb./A rate preemergence. On established plants use the 2 lb./A. rate when weeds are about 1 inch high. Temporary burning may occur on some varieties after spraying, but yields are not reduced.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Broccoli, cabbage and cauliflower (seed beds or field seeded)	Germinating annuals	CDEC (VEGADEX)	4	Before crop and weeds emerge.	Irrigate after application if soil is dry.
	Germinating grasses and some broadleaves	trifluralin (TREFLAN)	½ to ¾	Before planting.	Incorporate into soil 2 to 3 inches immediate after spraying. Use lowest rate on sandy soils. Not effective on muck soils.
Broccoli, cabbage and cauliflower (Transplants)	Emerged annuals	nitrofen (TOK)	2 to 4	One to two weeks after transplanting before weeds are 1 inch high.	Use wettable powder formulation. Temporary burning may occur on some varieties after spraying, but yields are not reduced.
	Germinating grasses and some broadleaves	trifluralin (TREFLAN)	½ to 1	Before transplanting.	Incorporate into soil 2 to 3 inches immediately after spraying. Use lowest rate on sandy soils and highest rate on soils high in clay or organic matter. Not effective on muck soils.
Carrots	Germinating or emerged annuals	linuron (LOROX)	1 to 2	Before crop emerges and again after carrots are 3 to 4 inches high.	Use lower rate on mineral soils and on established carrots. Do not apply over carrots when temperature exceeds 85°F and do not apply at pressures greater than 40 psi.
	Selected germinating annuals	chlorpropham (CHLORO IPC)	4	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 to 75 gallons	After carrots have 2 true leaves.	Don't spray within 42 days of harvest.
		chloroxuron (TENORAN)	3	After carrots form 2 true leaves and before weeds are 2 inches high.	Do not apply within 60 days of harvest. Not effective as a pre-emergence herbicide on muck soils.
		nitrofen (TOK)	3	After carrots form 2 true leaves and before weeds are 2 inches high.	Apply in 40 to 60 gallons of water/A. Especially effective on purslane. Does not control chickweed.
Celery (Transplants)	Germinating or emerged annuals	prometryne (CAPAROL)	1 to 2	Use 2 applications, 2 and 6 weeks after transplanting and before weeds are 2 inches high.	Do not exceed 4 lbs. per acre per year.
		nitrofen (TOK)	2	After transplanting and before weeds are 1 inch high.	Apply in 40 to 60 gallons of water per acre.
Celery (Outdoor seedbeds)	Emerged annuals	stoddard solvent (several trade names)	50 to 75 gallons	After celery has formed true leaves.	
Cucumbers (Seeded)	Germinating broadleaved annuals	naptalam (ALANAP)	4	Before cucumbers and weeds emerge.	Irrigate after application if soil is dry.
	Germinating grasses	bensulide (PREFAR)	6	Before or after planting.	With no irrigation, incorporate into soil 2 to 3 inches immediately after spraying and plant cucumbers. If irrigation is available, apply bensulide to soil surface after planting and irrigate immediately.
	Germinating broadleaves and grasses	naptalam (ALANAP plus bensulide) (PREFAR)	4 plus 6	After planting or in 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.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Cucumbers (seeded)	Germinating broadleaves and grasses	naptalam (ALANAP plus dinoseb) (PREMERGE, SINOX PE)	4 plus 2	Before cucumbers emerge.	Plant seed to a depth of 1 inch or injury may result. Do not use on sandy soils.
Cucumbers (Transplants)	Germinating annuals	naptalam (ALANAP)	4	Before or after transplanting and before weeds emerge.	Irrigate after application if soil is dry.
Dill	Emerged annuals	stoddard solvent	40 to 75 gallons	After two true leaves are formed.	
Eggplant	Germinating annuals	DCPA (DACTHAL)	8	After transplanting and before weeds emerge.	
Lettuce	Germinating annuals	chlorpropham (CHLORO IPC) plus CDEC (VEGADEX)	2 plus 4	Before lettuce and weeds emerge.	For muck soils only.
	Germinating annuals, especially grasses	benefin (BALAN)	1 to 1.5	Before planting.	Incorporate into soil 2 to 3 inches immediately after spraying. Not effective on muck soils.
Muskmelons (transplants)	Germinating broadleaves	naptalam (ALANAP)	4	After transplanting and before weeds emerge.	If soil is dry, irrigate after application.
	Germinating grasses	bensulide (PREFAR)	6	Before transplanting.	Incorporate into soil 2 to 3 inches immediately after spraying.
	Germinating broadleaves and grasses	naptalam (ALANAP) plus dinoseb (PREMERGE, SINOX PE)	4 plus 2	Before transplanting.	Can be utilized under clear plastic mulch.
Onions (seeded) Use these 2 herbicides according to your weed problem. A mixture of Randox + Chloro IPC at 3 plus 3 lbs. per acre usually controls more weeds than either chemical alone. Three or 4 applications at these lower rates give effective weed control without crop injury.	Germinating annuals	CDAA (RANDOX)	3 to 6	After planting until loop stage and again as needed after 2 true leaves form. Always apply before or just as weeds are emerging.	Particularly good on grasses, purslane, and pigweed. Apply Randox liquid no closer than 45 days before harvest. Use Randox granular no closer than 30 days before harvest.
		chlorpropham (CHLORO IPC)	3 to 6	After planting until loop stage and again as needed after 2 true leaves form. Always apply before or just as weeds are emerging.	Particularly good on purslane, chickweed, and smartweed. Apply no closer than 30 days before harvest.
	Emerged annual weeds	EXD (HERBISAN 5)	5 to 10	Before onions emerge or as a directed spray on established onions.	On established onions, use a shield so that only bottom 1 to 2 inches is sprayed. Apply no later than 48 hours before harvest. Use highest rate pre-emergence only.
	Emerged broadleaved weeds	nitrofen (TOK)	1 to 2	After onions have 3 true leaves and when weeds are less than 1 inch high.	Wettable powder formulation preferred. Do not apply with wetting agents or mix with liquid pesticides. Some temporary leaf burning may occur after application. Especially effective on purslane. Does not control chickweed. Do not apply at pressure greater than 40 psi.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Onions (seeded)	Emerged broadleaved weeds	chloroxuron (TENORAN)	2	After onions have 3 true leaves and when weeds are less than 1 inch high.	Do not apply with wetting agents or mix with other pesticides. Avoid application of other liquid pesticides within 4 days of chloroxuron application. Do not apply at pressure greater than 40 psi. Do not apply within 30 days of harvest.
Parsnips	Germinating annuals	linuron (LOROX)	1 to 2	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.
	Emerged annuals	stoddard solvent (SEVERAL TRADE NAMES)	40 to 75 gallons	After 2 true leaves are formed.	
Peas	Emerged annuals	dinoseb (PREMERGE, SINOX PE)	1 to 2	2 to 4-leaf stage.	Use 1 lb./A. when temperature 80°F., 1.5 lb. when temperature 70°F., and 2 lbs. when temperature 60°F. Do not apply after peas are 6 inches high. Do not graze or feed vines to livestock within 40 days after application.
	Germinating grasses and selected broadleaves	trifluralin (TREFLAN)	½ to ¾	Before planting.	Incorporate into soil 2 to 3 inches immediately after spraying. Use lowest rate on sandy soils.
Peppers (seeded)	Germinating annuals	diphenamid (DYMID, ENIDE)	5	Before peppers and weeds emerge.	Irrigate after application if soil is dry.
Peppers (transplants)	Germinating annuals	diphenamid (DYMID, ENIDE)	5	After transplanting and before weeds emerge.	Same as above.
		trifluralin (TREFLAN)	½ to 1	Before transplanting.	Incorporate into soil 2 to 3 inches immediately after spraying. Use lowest rate on sandy soils.
Radish	Germinating annuals	chlorpropham (CHLORO IPC)	2	Before radishes and weeds emerge.	If soil is dry, irrigate lightly after application.
Rutabaga and turnip	Germinating annuals	DCPA (DACTHAL)	8	Before crop and weeds emerge.	If soil is dry, irrigate lightly after application.
Spinach	Germinating annuals	CDEC (VEGADEX)	4	Before crop or weeds emerge.	Do not apply if temperatures are above 80°F. Irrigate after application if soil is dry.
		cycloate (RO-NEET)	3 to 4	Before planting.	Incorporate in soil 2 to 3 inches after spraying. Use on mineral soils only.
Squash and pumpkins	Germinating annuals	chloramben (VEGIBEN)	2	Before crop or weeds emerge.	If soil is dry, irrigate lightly after application.
Sweet corn	Germinating broadleaves	atrazine (AATREX)	1	After planting and before weeds are 1 inch high.	
	Germinating annuals, particularly grasses	atrazine (AATREX) and propachlor (RAMROD)	1 plus 3	Before crop or weeds emerge.	Available as a commercial mix or may be tank mixed.
	Quackgrass	atrazine (AATREX)	2 to 3	Before corn emerges.	Do not plant crops other than corn the following year.
	Nutsedge	atrazine (AATREX) and butylate (SUTAN)	1 plus 4	Before planting.	Incorporate into soil 2 to 3 inches after spraying.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Sweet potatoes	Germinating annuals	diphenamid (DYMID, ENIDE)	5	After planting and before weeds emerge.	
Tomatoes (seeded)	Germinating annuals	diphenamid (DYMID, ENIDE)	5	Before tomatoes or weeds emerge.	If soil is dry, irrigate after application.
Tomatoes (Transplants)	Germinating annual grasses and some broadleaves	trifluralin (TREFLAN)	½ to 1	Before transplanting.	Incorporate into soil 2 to 3 inches immediately after application. Use lowest rate on sandy soils.
		diphenamid (DYMID, ENIDE)	4 to 6	After transplanting and before weeds emerge.	
	Germinating annuals particularly broadleaves	chloramben (VEGIBEN)	2 to 4	Apply 3 to 5 days after transplanting and before weed emergence or later in the season after a cultivation.	Use granular formulation only. Effective on ragweed and smartweed. Use lowest rate on sandy soils.
SMALL FRUITS					
Blueberries and brambles (established at least one year)	Annuals	diuron (KARMEX)	2 to 4	In spring before weed growth starts.	Apply at least 60 days before harvest. Not effective on organic soils. Use low rate on young plantings.
		simazine (PRINCEP)	2 to 4	Late fall or in spring before growth starts.	Use low rate on young plantings.
	Quackgrass and annuals	dichlobenil (CASORON)	4 to 6	November.	Granular formulative is most effective on quackgrass. Do not exceed 4 lbs./A. on brambles.
		simazine (PRINCEP)	4	October or November.	Granular formulation is most effective on quackgrass.
Grapes	Annuals	diuron (KARMEX)	2 to 5	In spring before weed growth starts.	Use lower rates on sandy soils. Do not apply in vineyards less than 3 years old.
		simazine (PRINCEP)	2 to 4	In spring before weed growth starts.	Same as above.
	Quackgrass and emerged annuals	paraquat (PARAQUAT CL or DUAL PARAQUAT plus simazine (PRINCEP)	½ plus 4	Apply when weeds are 4 to 6 inches high.	For maximum knockdown, add a surfactant at 2 quarts per 100 gallons of spray.
		dichlobenil (CASORON)	6	November.	Granular formulation is most effective on quackgrass.
	Bindweed, milkweed and other perennials	paraquat (PARAQUAT CL or DUAL PARAQUAT)	½	In spring and summer before grape-shoots reach the ground.	Do not allow spray to touch grape leaves. For maximum knockdown, add a surfactant at 2 quarts per 100 gallons of spray. Repeat sprays 2 to 3 times in a season. Will remove suckers from base of trunk.
Strawberries (New and established plantings)	Germinating grasses	diphenamid (DYMID, ENIDE)	4 to 6	Five to 10 days after planting and before weeds emerge. In spring or fall on established fields.	Do not use on new plantings on sandy soils. Do not apply within 60 days of harvest. Controls seedling grains if applied prior to mulching.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Select strawberry herbicides according to your weed problem. If both grasses and broadleaves are a problem, use a combination of chloroxuron + diphenamid or chloroxuron + DCPA		DCPA (DACTHAL)	6 to 8	Five to 10 days after planting and before weeds emerge. In spring on established fields.	Particularly effective on sandy soils. Do not apply after first bloom.
	Germinating and emerged broadleaves	chloroxuron (TENORAN)	4	After transplanting and before weeds are 2 inches high. In fall or spring on established fields.	Do not apply within 60 days of harvest. Do not apply more than twice in a season.
TREE FRUITS					
First Year Plantings (apples, cherries, peaches, pears, plums)	Emerged annuals	paraquat (PARAQUAT CL, DUAL PARAQUAT)	½ to 1	Before or after planting trees and again during season as needed.	Spray in band about 4 feet wide. Two to 3 applications are needed for season-long control. Do not allow spray to touch foliage of trees.
Apples and Pears (established one year or more)	Germinating annuals	simazine (PRINCEP)	2 to 4	Fall or spring before weeds emerge.	Simazine rate may be decreased if weed control was complete in the previous year.
		diuron (KARMEX)	2 to 3	In spring before weeds emerge.	
	Quackgrass and emerged weeds	simazine (PRINCEP) plus amitrole-T (CYTROL)	4 plus 2	Before bloom when quackgrass has 2 to 6 inches of new growth.	Simazine rate may be decreased if weed control was complete in the previous year.
		diuron (KARMEX) plus amitrole-T (CYTROL)	3 plus 2	Same as above.	
		simazine (PRINCEP) + paraquat PARAQUAT CL, DUAL PARAQUAT	4 plus ½	Same as above.	Simazine rate may be decreased if weed control was complete in the previous year.
		dichlobenil (CASORON)	6	November.	Use granular formulation.
	All of the above				
Apples (established 3 years or more)	Quackgrass and annuals	terbacil (SINBAR)	1½ to 3	Late April or Early May.	Use lowest rate on sandy soils. On sand pockets or knobs, do not apply any chemical.
	Quackgrass	dalapon (DOWPON)	10	When quackgrass has 4 to 6 inches of new growth.	Will suppress quackgrass for 1 to 2 months.
	Bindweed, milkweed	2,4-D (WEEDONE 638 or DACAMINE 4D)	1	When weeds are growing rapidly.	Use these low volatile forms of 2,4-D only. Spray at low pressure when there is no danger of drift onto trees. Where growth is dense, use 80-100 gallons of water per acre.
	Poison Ivy Horsenettle, Canada thistle, Milkweed	Amitrole (AMINOTRIAZOLE, WEEDAZOL)	2	After harvest on bearing trees or when weeds are 4-6 inches high on non-bearing trees.	Do not allow spray to contact foliage of trees. Where growth is dense, use 80-100 gallons of water per acre with 2 gallons crop oil.
	Poison ivy and other woody perennials	AMS (AMMATE-X)	60 lb./-100 gal.	When poison ivy is growing rapidly.	Apply as a spot spray in infested areas, wetting the poison ivy foliage thoroughly. Do not allow spray drift to contact tree foliage and avoid wetting tree trunks.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Cherries (tart and sweet), peaches and plums (established one year or more)	Annuals and quackgrass	simazine (PRINCEP) plus paraquat (PARAQUAT CL or DUAL PARAQUAT)	2 to 4 plus ½	When weeds are 2 to 4 inches high.	Do not spray on sand pockets or knobs, use lowest rate of simazine on plums. Simazine rate may be decreased if weed control was complete in the previous year.
		simazine (PRINCEP)	4	October or November	Use granular formulation. More effective if followed by paraquat at ½ lb./A. in the spring.
		dichlobenil (CASORON)	6	November	Use granular formulation.
Peaches (established 3 years or more)	Annuals and quackgrass	terbacil (SINBAR)	1½ to 3	Late April or early May.	Use lowest rate on sandy soils. On sand pockets or knobs, do not apply any chemical.

ORNAMENTALS

Transplanted Ageratum Chrysanthemums Geraniums Marigolds Petunias Salvia Zinnia	Germinating annuals	trifluralin (TREFLAN)	1 to 3	Before or after planting and before weeds emerge.	When applied before planting use 1 lb./A. and incorporate in soil 2 to 3 inches. After planting use granular formulation at 3 lb./A. and irrigate after application.
		EPTC (EPTAM)	3	After planting and before weeds emerge.	Use granular formulation only. Irrigate after application.
		diphenamid (DYMID, ENIDE)	5	After planting and before weeds emerge.	Irrigate after application if soil is dry.
Gladiolus	Germinating annuals	diuron (KARMEX)	1	After planting and before crop or weeds emerge.	
		trifluralin (TREFLAN)	½ to 1	Before planting.	Incorporate into soil 2 to 3 inches after spraying. Use lowest rate on sandy soils. Do not apply on small cormels.
		dinoseb (PREMERGE, SINOX PE)	4 to 8	Before emergence only.	Use 4 lb./A. on cormels.
Peonies	Germinating annuals	simazine (PRINCEP)	2 to 3	Fall or spring before emergence.	Use fall application to control winter annuals.
		diuron (KARMEX)	1 to 2	Fall or spring before emergence.	
Roses	Germinating annuals	simazine (PRINCEP)	2 to 4	Fall or spring, before weeds emerge.	Use fall application to control winter annuals.
		trifluralin (TREFLAN)	1 to 3	Before or after planting and before weeds emerge.	When applied before planting, use 1 lb./A. and incorporate in soil 2 to 3 inches. After planting use granular form at 3 lb./A. and irrigate after application.
	Quackgrass and annuals	dichlobenil (CASORON)	4 to 6	In fall or early spring.	Granular formulation preferred.
Tulips, Daffodils	Annuals	simazine (PRINCEP)	1 to 2	Fall or early spring before emergence.	
		dinoseb (PREMERGE, SINOX PE)	4 to 6	Fall	

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Nursery Stock — Note: Check product labels closely for species that will safely tolerate each herbicide.					
Container stock	Annuals	dichlobenil (CASORON)	3 to 5	Before weed emergence.	Check label for species that will tolerate these herbicides. Granular formulations should be used. Granules may be mixed with mulching material to make application easier.
		simazine (PRINCEP)	2 to 4	Same as above	
		trifluralin (TREFLAN)	2 to 4	Same as above	
Lining-out stock (evergreens and deciduous)	Annuals	trifluralin (TREFLAN)	½ to 1	Before transplanting	Incorporate into soil 2 to 3 inches after spraying.
		simazine (PRINCEP)	1 to 2	Two to 4 weeks after transplanting.	Band spray if cover crop is desired. Do not use on extremely sandy soil.
		dichlobenil (CASORON)	3 to 5	Four weeks after transplanting.	Band spray if cover crop is desired. Do not use on extremely sandy soil.
Established nursery stock (evergreens and decidous shrubs)	Germinating annuals	simazine (PRINCEP)	2 to 4	In spring before weed emergence.	Use lower rate on sandy soils.
		trifluralin (TREFLAN)	1	Same as above.	Incorporate in soil 2 to 3 inches after application.
		diphenamid (DYMID, ENIDE)	6	Late summer or fall.	Particularly effective on annual grasses and winter annual weeds.
	Quackgrass and annuals	dichlobenil CASORON	6	Fall.	Use granular formulation. Do not use on extremely sandy soils.
Shade and Fruit Trees	Quackgrass, annuals and perennials	simazine (PRINCEP) plus amitrole-T (CYTROL)	2 to 4 plus 2	In spring when quackgrass is 4 to 6 inches high.	Do not allow spray to touch foliage of trees.
		simazine (PRINCEP) plus paraquat (PARAQUAT CL, DUAL PARAQUAT)	2 to 4 plus ½	In spring when weeds are 4 to 6 inches high.	Do not allow spray to touch foliage of trees.
Ground Covers (English ivy, Pachysandra)	Annuals	simazine (PRINCEP)	2	7 to 10 days after planting and before weeds emerge.	Do not use on extremely sandy soils.
		trifluralin (TREFLAN)	1	Before planting.	Incorporate in soil 2 to 3 inches after spraying. Granular formulation may also be used in established plantings.
(Myrtle)	Annuals	diphenamid (DYMID, ENIDE)	5	7 to 10 days after planting and before weeds emerge.	
		EPTC (EPTAM)	3	Same as above.	Irrigate after application. Use granular formulation only.
(Ajuga)	Annuals	norea (HERBAN)	2 to 3	7 to 10 days after planting and before weeds emerge.	Do not use on extremely sandy soils.
		trifluralin (TREFLAN)	1	Before planting.	Incorporate in soil 2 to 3 inches after spraying.

Crop	Weed Problem	Chemical	Pounds Per Acre Active Ingredient	Time of Application	Remarks and Limitations
Potting Soil and Transplant Beds					
	All weeds	methyl bromide and chloropicrin (MC-33)	1 to 2 lb. per 100 sq. feet	14 to 21 days before using	Follow label instructions carefully.
	All weeds	metham (VAPAM, VPM, METAM	1 to 2 quarts per 100 sq. ft.	Several weeks before using.	Follow label instructions carefully.
	All weeds	Dazomet (MYLONE, MICO-FUME)	1 to 2 lb. per 100 sq. ft.	Several weeks before using.	Read the label. Follow label instructions carefully.
Quackgrass Control Before Growing Crop					
	Quackgrass	amitrole-T (CYTROL)	2 to 4	Before August, preferably in spring.	Must wait 8 months before planting food crops except corn, wait 10 days before planting corn. Addition of a crop oil at 2 gal./40 gal. of spray will increase effectiveness. Plow or work soil 10-14 days after spraying.
	Quackgrass	dalapon (DOWPON)	10 to 20	Sept. to Nov. 15.	Apply when grass is at least 4 inches high. If quackgrass is low in vigor, apply nitrogen to stimulate growth 2 weeks before spraying.
	Quackgrass	dalapon (DOWPON)	10	Spring when grass is at least 4 inches high.	Wait at least five weeks before planting. Do not use in the spring before planting strawberries.
Perennial Weed Control In Non-Crop Areas					
	Poison ivy, Canada thistle and horsenettle	Amitrole (AMINOTRIAZOL, WEEDAZOL)	2 to 4	Spring or summer during active growth.	Apply when weeds are in full leaf but before flowers appear. Use lower rate on poison ivy. Where growth is dense, use 2 gallons of crop oil with 80-100 gallons of water per acre.
	Poison ivy	AMS (AMMATE-X)	60 lb./100 gal.	When poison ivy is in full leaf.	Thoroughly wet the foliage of poison ivy in infested areas. Avoid drift onto crop plants.

PERSONAL RECORD OF WEED SPRAYING OPERATIONS FOR 1971

I. Calibration of Equipment — A. Speed or gear and throttle setting ..... B. Nozzle size ..... C. Pressure (Pounds per square inch) ....., Amount of water sprayed per acre under above conditions .....

II. Spraying Records.

Date	Crop	Chemicals and rates	Number acres sprayed	Amounts of chemicals used

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914 in cooperation with the U.S. Department of Agriculture, Geo. S. McIntyre, Director, Cooperative Extension Service, Michigan State University, E. Lansing, Mich. 48823.

1P-7R-2/71-20M-HK