
2000

WEED CONTROL GUIDE FOR VEGETABLE CROPS



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The Vegetable Crop Advisory Team (CAT) Alert Newsletter

Get the right pest management information, at the right time



The right information from Michigan State University Extension's faculty and field staff

The *CAT Alert* newsletter articles respond to current outbreaks and recommended long-term preventative actions. Our recommendations include resistance management and protecting beneficial organisms. The following subjects are covered:

- Managing insects, diseases, and weeds on upland and muck vegetables including potatoes
- Pesticide regulations and registration changes including emergency registrations
- Weather conditions, growing degree days, precipitation totals, and production implications
- European corn borer trap catches, tomato and onion disease forecaster reports and scouting advice
- Special features on soil fertility for vegetable fields, and potato production including late blight management

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Our newsletters are written, formatted, printed and mailed within 48 hours. With Internet access, you can view the newsletter on your computer screen within about 8 hours of the start of our production (Visit <http://www.msue.msu.edu/ipm/vegCAT.htm>). We look at conditions in surrounding states, data on trends from past years, insect trap catches, forecasting tools and the reports of our agricultural meteorologist to predict what your pest management needs will be.

Our season begins April 2000. Most issues arrive during the growing season, but pre- and post-season issues will address preventative measures and harvest or storage concerns. Send your subscription in any time during the year. We'll send back issues from the current publishing year, if you subscribe before July 1. Each subscription for the season is \$35. After July 1, the price is \$15 and does not include back issues. Fill out this form to subscribe to the 2000 Vegetable *CAT Alert* newsletter.

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Herbicide Information

Some herbicides containing the same active ingredients but different trade names are marketed by more than one company. Also, some herbicides are produced in several formulations. Products recommended in this bulletin are commonly used formulations of common herbicides. Other products and formulations may be equally as good. Check labels on containers to determine that the product is labeled for your intended target crop and the amount of product to use per acre.

Pesticide Information

This publication contains pesticide recommendations based on research and pesticide regulations. However, changes in pesticide registrations occur constantly. Some pesticides mentioned may no longer be available, and some may no longer be legal in your state. The use of a pesticide in a manner not consistent with the label can lead to injury of crops, humans, animals, and the environment, and can lead to civil fines and/or condemnation of the crop. If you have questions about the legality and/or registration status of pesticides, contact your county Extension office, pesticide dealer, or manufacturer.

To protect yourself, others and the environment, always read the label before applying any pesticide.

2000 Weed Control Guide for Vegetable Crops

Bernard H. Zandstra, Department of Horticulture, Michigan State University

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Information on Environmental Protection and Herbicide Use

Profitable crop production depends on effective weed control. 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.

An effective weed control program includes environmentally sound cultural, mechanical, and chemical weed-control methods. The increasing concern with pesticide residues in the environment, food, and groundwater make it especially important that growers use herbicides as efficiently as possible. Crop rotation, cultivation, use of cover and companion crops, and use of different herbicides help avoid buildup of resistant weeds and pesticide residues in the soil.

Pesticides and the Environment

Groundwater is stored in water-bearing geological formations called **aquifers**. It moves through aquifers and is obtained at springs, streams, or wells. Many people obtain their drinking water from wells. Well water is groundwater.

The upper level of the saturated zone in the soil is called the **water table**. The water table depth fluctuates, depending on the amount of water removed from the ground and the amount of water added by recharge.

Both surface water and groundwater are subject to contamination by **point and nonpoint source pollution**. Point source contamination refers to movement of a pesticide into water from a specific site. Nonpoint source contamination generally results from land runoff, precipitation, acid rain, or percolation rather than from discharge at a single location.

Several factors influence the fate of herbicides in groundwater.

Adsorption is the binding of chemicals to soil particles. The amount and persistence of pesticide adsorption varies with pesticide properties, soil moisture, soil pH, and soil texture. Soils high in organic matter or clay are the most adsorptive; coarse, sandy soils are much less adsorptive.

A soil-adsorbed herbicide is less likely to volatilize, leach or be degraded by microorganisms. It is also less available for absorption by plants.

Volatilization occurs when a solid or a liquid turns into a gas. A pesticide in a gaseous state can be carried away from the treated area by air currents. This is called **vapor drift**. Unlike the drift of sprays and dusts that can sometimes be seen during application, vapor drift is invisible.

Avoid applying volatile herbicides when conditions favor volatilization, such as temperature inversions. Herbicide labels usually mention the potential for volatility of herbicides. Volatilization can sometimes be reduced through the use of low volatile formulations or soil incorporation of the herbicide.

Photodegradation is the breakdown of herbicides by the action of sunlight. Herbicides applied to foliage or the soil surface may be broken down by exposure to light. Soil incorporation can reduce herbicide exposure to sunlight.

Microbial degradation occurs when microorganisms such as fungi and bacteria use a herbicide as a food source. Conditions that favor microbial growth include warm temperatures, favorable pH levels, adequate soil moisture, oxygen, and fertility. Adsorbed herbicides are more slowly degraded because they are less available to some microorganisms.

Chemical degradation is the breakdown of a herbicide by soil processes not involving a living organism. Adsorption of the herbicides, soil pH, soil temperature, and moisture influence the rate of degradation. Some herbicides are more rapidly degraded on low pH soils.

Absorption is the process by which plants and microorganisms take up chemicals. Once absorbed, most herbicides are degraded within plants. Residues may persist inside the plant or be released back into the environment as the plant decays.

Runoff moves herbicides in surface water, either mixed in the water or bound to soil particles. The amount of herbicide runoff depends on the grade or slope of the field, the type of soil, the amount of rainfall (especially close to the time of application), and properties of the herbicide. For example, a herbicide applied to a saturated clay soil is highly susceptible to runoff. Established vegetation or plant residues reduce runoff.

Herbicide runoff is greatest when heavy rainfall occurs shortly after application. No-tillage, minimum-tillage, and soil incorporation reduce runoff. Surface grading, drainage ditches and dikes, and the use of border vegetation can help reduce herbicide movement into surface water.

Leaching is the movement of herbicides through the soil into groundwater. Several factors influence leaching including water solubility of the herbicide, soil structure and texture, and persistence of herbicide adsorption to soil particles. If an herbicide is strongly adsorbed to soil particles, it is less likely to leach, regardless of its solubility, unless the soil particles themselves move with the water flow.

Keeping Herbicides Out of Groundwater and Surface Water

It is very difficult to purify or clean contaminated groundwater or surface water. Management practices can be implemented to effectively reduce pesticide runoff and leaching and protect groundwater and surface water.

- **Use integrated crop management practices**—Minimize herbicide use by combining chemical control with other pest management practices such as tillage,

- cultivation, crop rotation, and pest scouting.
- **Reduce compaction**—Surface water runoff increases when soils are compacted.
 - **Rotate crops**—Crop rotations may provide more surface crop residue and may reduce the application of the same pesticides to a field.
 - **Use conservation tillage practices**—Include no-till, minimum till, cover crops, grass waterways and buffer strips.
 - **Consider the geology of your area**—When planning herbicide applications, be aware of the water table depth and the permeability of the geological layers between the surface soil and groundwater.
 - **Select herbicides carefully**—Choose herbicides with the least potential for leaching into groundwater or for runoff into surface water.
 - **Transport Pesticides Safely**—Have pesticides delivered directly to your pesticide storage facility to avoid liability and potential accidents and spills in transit whenever possible. U.S. DOT shipping rules must be followed for transporting large quantities of pesticides, including proper placarding of the vehicle, liability insurance, special handling requirements, etc.
 - **Follow label directions**—The label carries crucial information about the proper rate, timing, and placement of the herbicide.
 - **Calibrate accurately**—Equipment should be calibrated carefully and often.
 - **Measure accurately**—Concentrates need to be carefully measured before they are placed into the spray tank. Do not “add a little extra” to ensure the herbicide will do a better job.
 - **Avoid back-siphoning**—The end of the fill hose should remain above the water level in the spray tank at all times to prevent back-siphoning of chemical into the water supply. Use an anti-backflow device when siphoning water directly from a well, pond, or stream. These practices also reduce the likelihood of the hose becoming contaminated with herbicides.
 - **Consider weather and irrigation**—If you suspect heavy or sustained rain, delay applying herbicides. Control the quantity of irrigation to minimize the potential for herbicide leaching and runoff.
 - **Avoid spray drift and volatilization**—Do not spray when the wind is greater than 10 miles per hour and/or weather conditions (e.g. inversions) are conducive to pesticide drift from the target area. Make every effort to AVOID PESTICIDE DRIFT!
 - **Clean up spills**—Avoid spills. When they do occur, contain and clean them up quickly with an absorbent material such as cat litter. Chemicals spilled near wells and sinkholes can move directly and rapidly into groundwater. Chemicals spilled near ditches, streams, or lakes can move rapidly into surface water.
 - **Change the location of mixing areas**—Mix and load pesticides on an impervious pad, if possible. If mixing is done in the field, change the location of the mixing area regularly. Do not mix herbicides adjacent to the water source, and do not let the water run inadvertently onto the soil near the mixing area. This will increase herbicide leaching and/or runoff.
 - **Dispose of wastes and containers properly**—All herbicide wastes must be disposed of in accordance with local, state, and federal laws. Pesticide containers are considered hazardous waste until they are cleaned or disposed of properly. When possible, reduce the number of pesticide containers by using bulk or returnable containers.

All pesticide containers can be rendered nonhazardous waste by triple rinsing (or equivalent). The rinsate should be added to the spray tank. After triple rinsing, perforate both ends so the container cannot be reused.

All metal and plastic triple-rinsed containers should be recycled, if possible. If this option is not available, dispose of them in a state-licensed sanitary landfill. Dispose of all paper containers in a sanitary landfill or a municipal waste incinerator.
- Do not bury or burn any pesticide containers. Do not reuse any empty pesticide containers for any purpose.
- **Store herbicides away from water sources**—Herbicide storage facilities should be situated away from wells, cisterns, springs, and other water sources. Pesticides must be stored in a facility that will protect them from temperature extremes, high humidity, and direct sunlight. The storage facility should be heated, dry and well ventilated. It should be designed for easy containment and cleanup of pesticide spills and made of materials that will not absorb any pesticide material that leaks out of a container. Store only pesticides in such a facility and always store them in their original containers.

Do not store any protective clothing or equipment in the pesticide storage facility. Store herbicides separately from insecticides and fungicides to avoid contamination of one material by another and accidental misuse.

Keep the facility locked at all times when not in use to prevent animals, children, and irresponsible adults from entering and becoming poisoned. Post the facility as a *Pesticide Storage Facility* to warn others that the area is off limits. Maintain an accurate inventory of the pesticides stored in the facility at all times in case of emergency.

Always read and follow the *Storage and Disposal* section of pesticide labels for specific storage and handling instructions.

For additional information on pesticide storage, refer to Midwest Plan Service Bulletin 37, *Designing Facilities for Pesticide and Fertilizer Containment*, available from Agriculture and Biosystems Engineering Dept., 122 Davidson Hall, Iowa State University, Ames, IA 50011; and Michigan Bulletin E-2335, *On-Farm Agricultural Storage and Handling*.

Your state’s water resources currently provide a vast supply of clean water for agriculture, homes, and industry. They can ensure high water quality for future needs only if they are protected now. Be sure to understand how your activities,

including herbicide usage, can affect them.

Michigan Groundwater Stewardship Program (MGSP)

The Michigan Groundwater Stewardship Program (MGSP) is a cooperative effort designed to reduce the risks of groundwater contamination associated with the use of pesticides and nitrogen fertilizers. The MGSP was created in 1993 by the state legislature, and is funded by assessments on the sale of nitrogen fertilizers and pesticides. The assessment generates \$3.5 million each year that is used to deliver educational programs, technical assistance, and cost share that meet the needs and interests of pesticide and fertilizer users. Local MGSP's, usually associated with a county MSU Extension or Conservation District office, provide assisted farmstead pollution risk assessments (Farm*A*Syst and Field*A*Syst), help in developing a groundwater stewardship plan, provide cost share funds that are used to install groundwater stewardship practices, and conduct educational workshops and on-farm demonstrations.

The MGSP also sponsors the Spill Response Program (1-800-405-0101) to assist individuals dealing with pesticide, fertilizer and manure spills; Clean Sweep to dispose of unused and unwanted pesticides safely; Container Recycling to assist in the safe disposal of plastic pesticide containers; and the Michigan Emergency Tube project that provides an emergency preparedness plan that helps meet the legal requirements of SARA Title III. Growers who participate in some of these programs are also eligible to obtain pesticide recertification credits.

Contact your MSU Extension, Conservation District, or USDA NRCS representative to learn more about the MGSP serving your county.

Pesticide Emergency Preparedness

When purchasing a pesticide, obtain a specimen label from the dealer and keep it on file on the

farm. This label will be available immediately if an emergency involving a pesticide occurs. Take the label along to a medical treatment center if an individual has suffered pesticide poisoning.

Read and observe closely the *Precautionary Statements* section of the label. Make sure that several people are aware of, and can administer, treatments for pesticide poisoning contained in the *Statement of Practical Treatment* on the label. (See also section on SARA Title III.)

Handling and Mixing Pesticides

Always wear protective clothing and equipment when handling, mixing, and applying pesticides and during cleanup of application equipment. Always wear the personal protective equipment specified on the pesticide label.

Mix pesticides downwind and below eye level. Avoid excessive splashing and sloshing. If pesticides are spilled on you, wash them off immediately with lots of water and change your clothing. Resume spraying only after cleaning up any spills. Try to use closed handling/mixing systems when appropriate.

Keep unauthorized persons out of the area in which you handle pesticides.

Cleaning Pesticide Application Equipment

Follow all specific label directions for cleaning application equipment. 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, usually 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 through the nozzles. Apply the rinsate to cropland not exceeding labeled rates. Repeat the process when changing herbicides and at the end of each day.

Clean sprayers completely when changing from herbicides to other pesticides. Add 1 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 the washing solution to crops. Rinse the system with water after draining the rinsate. Do not leave pesticide solution or cleaning solution in the tank overnight.

Protect Nontarget Organisms

Applying pesticides carelessly can harm nontarget organisms that are beneficial to agriculture and our environment. The best way to avoid injury of beneficial insects and microorganisms is to minimize pesticide use. Selective pesticides should be used whenever possible and applied only when necessary as part of a total pest management program.

Pesticides can be harmful to all kinds of vertebrates such as **fish** and **wildlife**. Most recognizable are the direct effects from acute poisoning. Fish kills often result from water pollution by a pesticide (usually insecticides). Pesticides can enter water via drift, surface runoff, soil erosion, and leaching.

Bird kills from pesticides can occur when birds ingest the toxicant in granules, baits, or treated seed; or are exposed directly to the spray; or consume a treated crop; or drink and use contaminated water; or feed on pesticide-contaminated prey.

Worker Protection Standard

New federal rules for farm worker protection have been in effect since 1995. The Worker Protection Standard (WPS) covers pesticides that are used in the production of agricultural plants on farms, forests, nurseries, and green-

houses. The operators of these businesses are required to provide employees with:

- Information in the form of pesticide safety training, pesticide safety poster, access to labeling information, and access to an application list of pesticide treatments on the establishment.
- Protection to ensure that employees will be protected from exposures to pesticides. Employers are required to prohibit handlers from applying pesticides in any way that will expose workers or others, exclude workers from areas being treated with pesticides, and exclude workers from areas that remain under a restricted entry interval (REI), protect early entry workers who are doing permitted tasks in an area under REI, notify workers about treated areas, monitor handlers who are using highly toxic pesticides and provide instruction for use of personal protective equipment.
- Mitigation in the form of decontamination sites for washing-up in the field, and emergency assistance to make transportation available to a medical facility in the event of a pesticide-related injury or illness.

Details for compliance with the Worker Protection Standard as well as other regulations affecting worker safety can be obtained at your county MSU Extension office.

Right-to-Know

Plan to conduct a farm worker Right-to-Know training program for all your employees. Use this training time to maintain and improve safety procedures for using agricultural chemicals on your farm. Contact your county Extension agent to assist you in setting up a right-to-know employee training program.

Record Keeping

The 1990 Farm Bill requires that all applicators who apply restricted use pesticides (RUP) keep records and maintain them for two years. Records to be kept include:

- brand name or product name and the EPA registration number.

- total amount of the product used.
- size of the area treated.
- crop, commodity, stored product or site to which the pesticide was applied.
- location of the application.
- month, day and year of the application.
- name and certification number of the applicator or applicator's supervisor.

Any record form is acceptable as long as the required data is included. Penalties are up to \$500 for the first violation and up to \$1,000 for subsequent violations. Provisions for protecting the identity of the individual producers are included in the law. Commercial applicators must furnish a copy of the required records to the customer of the RUP application.

Endangered Species Act

To minimize the adverse impact of pesticides on endangered species, the EPA has initiated The Endangered Species Act. The Michigan Department of Natural Resources (MDNR) administers the Michigan Endangered Species Act and maintains the federal and state endangered species lists in the state. Pesticide applications are a potential problem, particularly affecting birds, butterflies and moths. Alteration of the farm landscape can also negatively affect resident endangered species.

The Environmental Protection Agency (EPA) has determined threshold pesticide application rates that may affect listed species. This information is or will be included on pesticide labels. Counties with vulnerable endangered or threatened species will be identified on pesticide labels. Farmers must take the initiative and consult with the MDNR and the Fish and Wildlife Service (FWS) to be sure there are no endangered species in their area. The Nature Conservancy, a private land and habitat conservation organization, is working with the MDNR and the FWS and is conducting a landowner contact program to work with landowners who own property important for endangered species protection.

SARA Title III Emergency Planning and Community Right to Know Act

The Emergency Planning and Community Right to Know Law, under SARA Title III, requires farmers to notify their State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and local fire department that they store extremely hazardous materials along with the name and telephone number of the facility representative. Check with your state Department of Environmental Quality or Extension to receive a list of EPA established "Extremely Hazardous Substances" and their threshold planning quantities.

The LEPC and fire chief may request maps of your storage facility and detailed lists of materials you store.

This law also requires, in the event of a spill, the SERC, LEPC and National Response Commission be notified. The reportable quantities for spills is much less than for storage and can be obtained from the above sources. See Extension Bulletin E-2575 for more details on SARA Title III and a list of commonly used extremely hazardous substances.

Right to Farm

Farmers in Michigan are protected from nuisance lawsuits under the Right to Farm Act if they follow specific acceptable management practices. The Generally Accepted Agricultural and Management Practices for pesticide utilization and pest control, nutrient utilization, and manure management have been completed and are revised annually. Contact your Extension agent or regional office of the Michigan Department of Agriculture to obtain copies.

Spraying Equipment

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

1. A tank with a volume of 100 to 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 agitation line into the bottom of the tank. Make sure there is always some agitation in the tank.

4. Screens—There should be 50 mesh screens in the intake line and at each nozzle.

5. Pressure gauge—A pressure gauge calibrated to 100 PSI should be mounted on the boom as near to the nozzle as possible.

6. Boom—The boom should be adjustable from 18 to 36 inches above the ground. It should be built so that it contains shock absorbers to keep the boom level when going over rough 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 the carrier (usually water) in gallons per acre (GPA). Ten to 30 GPA at 30 to 40 PSI is sufficient for most weed control applications.

2. **Adjust** the boom height so that the spray overlaps about 30 percent 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 to 7 to change the 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.

Key to Abbreviations in This Publication

a = acre

ae = acid equivalent

ai = active ingredient

AMS = ammonium sulfate

AS = aqueous suspension

COC = crop oil concentrate

DF = dry flowable

DG = dispersible granule

DS = dry soluble

E or **EC** = emulsifiable concentrate

ES = emulsifiable solution

F = flowable

gal = gallon

G = granule

lb = pound

L = liquid

ME = micro-encapsulated

NIS = nonionic surfactant

oz = ounce

pt = pint

PHI = preharvest interval

POST = postemergence

PPI = preplant incorporated

PRE = preemergence

PSI = pounds per square inch

qt = quart

RUP = restricted use pesticide

SL = soluble liquid

S or **SP** = soluble powder

UAN = urea ammonium nitrate, 28%

W or **WP** = wettable powder

WSG = water soluble granule

yr = year

Table 1. Herbicide formulations, sources, toxicity, runoff and leaching potential and REI.

Common Name	Trade Name ¹ and Manufacturer	Formulations	Runoff/Leaching ² Potential	LD ₅₀ mg/kg ³		REI ⁴
				Oral	Dermal	
• acetachlor	HARNESS (Monsanto)	7E	2/2	2690	>5000	12 hrs
	SURPASS (Zeneca)	6.4E	2/2	1426-1942	>2240	12 hrs
• alachlor	LASSO (Monsanto)	4E	2/2	2000	7800	12 hrs
• atrazine	several	4L	2/1	1075-1886	>5000	12 hrs
benefin	BALAN (UAP)	60DF	1/3	500	2000	12 hrs
bensulide	PREFAR (Gowan)	4E	1/2	704-819	>2000	12 hrs
bentazon	BASAGRAN (BASF)	4SL	3/1	2063	>10000	12 hrs
bromacil	HYVAR X (DuPont)	80W	2/1	1300-2000	>5000	12 hrs
bromoxynil	BUCTRIL (Rhone-Poulenc)	2E	2/3	780	>2000	12 hrs
butylate	SUTAN PLUS (Zeneca)	6.7E	2/3	3500	>4640	12 hrs
clethodim	SELECT (Valent)	2E	3/3	2920-3610	>5000	24 hrs
clomazone	COMMAND (FMC)	4E	2/2	1406	>2000	12 hrs
	COMMAND (FMC)	3ME	2/2	>5000	>5000	12 hrs
clopyralid	STINGER (DowAgrosciences)	3L	3/1	>5000	>5000	12 hrs
• cyanazine	BLADEX (DuPont)	4L	2/2	473-510	>2000	12 hrs
	CYPRO (Griffin)	4L	2/2	500	>5000	12 hrs
cycloate	RO-NEET (Zeneca)	6E	2/2	3160-3690	>4640	12 hrs
DCPA	DACTHAL (Zeneca)	75W	1/3	>10000	>10000	12 hrs
dicamba	BANVEL, CLARITY (BASF)	4L	3/1	2629	>2000	24 hrs
dimethenamid	FRONTIER (BASF)	6E	2/2	849	>2000	12 hrs
diquat	DIQUAT (Zeneca)	2L	1/3	600-810	260-315	24 hrs
diuron	KARMEX, DIREX (Griffin)	80DF	1/2	2900	>2000	12 hrs
endothall	DESICATE II (Elf Atochem)	2L	3/2	1174	362	48 hrs
EPTC	EPTAM (Zeneca)	7E	2/3	1325-4500	2750	12 hrs
	ERADICANE (Zeneca)	6E	2/3	2000-2870	>4000	12 hrs
ethalfuralin	CURBIT (UAP)	3E	1/3	10,000	2000	12 hrs
fluazifop-P	FUSILADE DX (Zeneca)	2E	1/3	>5000	>2000	12 hrs
fosamine	KRENITE (DuPont)	4L	2/3	>5000	>5000	—
glufosinate	RELY (AgrEvo)	1L	2/3	3570	>2000	12 hrs
glyphosate	ROUNDUP (Monsanto)	4L	1/3	>5000	>5000	12 hrs
halosulfuron	PERMIT (Monsanto)	75WSG	2/2	1287	>5000	12 hrs
hexazinone	VELPAR (DuPont)	90SP	2/1	1100	>5000	24 hrs
imazethapyr	PURSUIT (American Cyanamid)	2L	3/1	>5000	>5000	4 hrs
linuron	LOROX, LINEX (Griffin)	50DF	1/2	4060-4833	>2000	24 hrs
MCPB	THISTROL (Rhone-Poulenc)	2L	3/1	4738	>2000	12 hrs
s-metolachlor	DUAL MAGNUM (Novartis)	7.6E	2/1	820-2500	>5000	24 hrs
metribuzin	SENCOR (Bayer)	75DF	2/1	2000-2795	>5000	12 hrs
napropamide	DEVRIKOL (United Phosphorus)	50DF	1/2	>5000	>2000	12 hrs
naptalam	ALANAP (Uniroyal)	2L	-/-	>5000	>20000	48 hrs
nicosulfuron	ACCENT (DuPont)	75 SP	3/1	>5000	>2000	4 hrs
norflurazon	SOLICAM (Novartis)	80DF	1/2	1140	>2000	12 hrs
oryzalin	SURFLAN (DowAgrosciences)	4AS	2/3	5000	>5000	24 hrs
oxyfluorfen	GOAL XL (Rohm & Haas)	2E	-/-	>2000	>2990	24 hrs
• paraquat	GRAMOXONE EXTRA (Zeneca)	2.5L	1/3	283	>2000	24 hrs
pebulate	TILLAM (Zeneca)	6E	2/3	1390-1400	>2000	12 hrs
pendimethalin	PROWL (American Cyanamid)	3.3E	1/3	3956	>2200	24 hrs
	PENTAGON (American Cyanamid)	60DG	1/3	>5000	>2000	24 hrs
phenmedipham	SPIN-AID (AgrEvo)	1.3E	1/3	4000	>8700	24 hrs
primisulfuron	BEACON (Novartis)	75DG	2/1	>5050	>2010	12 hrs
prometryn	CAPAROL (Novartis)	4L	1/2	>5000	>2000	12 hrs
	COTTONPRO (Griffin)	4L	1/2	>5000	>2000	12 hrs
pronamide	KERB (Rohm & Haas)	50W	2/1	>5000	>2000	24 hrs
pyrazon	PYRAMIN (BASF)	68DF	2/2	1160	>2000	12 hrs
pyridate	LENTAGRAN (Gowan)	45WP	-/-	2330	>2000	12 hrs
quizalofop	ASSURE II (DuPont)	.88E	1/2	4100-5900	>2000	12 hrs
rimsulfuron	MATRIX (DuPont)	25DF	-/-	>5000	>2000	4 hrs
sethoxydim	POAST (BASF)	1.5E	2/3	4100	>5000	12 hrs
sulfometuron	OUST (DuPont)	75DG	2/2	>5000	>2000	4 hrs
sulfosate	TOUCHDOWN (Zeneca)	6L	1/3	750	>2000	12 hrs
tebuthiuron	SPIKE (DowAgrosciences)	80W	2/1	1118-3536	>2000	—
terbacil	SINBAR (DuPont)	80W	2/1	>5000	>5000	12 hrs
triclopyr	GARLON (DowAgrosciences)	4L	3/1	1350-1600	>2000	12 hrs
trifluralin	TREFLAN (DowAgrosciences)	4E	1/3	3700	>5000	12 hrs
2,4-D	FORMULA 40 (Rhone-Poulenc)	4L	3/2	375-699	>2000	48 hrs
	WEEDAR 64 (Rhone-Poulenc)	4L	3/1	1161	1544	48 hrs
2,4-D + triclopyr	CROSSBOW (DowAgrosciences)	3L	2/1	2400-2590	>2000	—

¹ 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 also may be labeled for use on certain crops. The mention of trade names does not imply that they are endorsed or recommended over those of similar nature not listed.

² The runoff/leaching potential ratings are from the NRCS Field Office Technical Guide—Section II Water Quality and Quantity Interpretations. 1 = large, 2 = medium, 3 = small.

³ The LD₅₀ is a standard toxicological term which indicates the number of milligrams (mg) of pesticide per kilogram (kg) of test animal body weight required to kill 50 percent of a test animal population. Values less than 10 indicate extremely high toxicity to mammals. The LD₅₀ data were obtained from the Material Safety Data Sheets.

⁴ REI = Restricted Entry Interval for the Worker Protection Standard. SL = see label.

• RESTRICTED USE PESTICIDES. All or certain formulations of these herbicides have been classified as Restricted Use Pesticides (RUP) and are available only to certified applicators.

Table 2. Effectiveness of Preplant Incorporated and Preemergence Herbicides on Weeds.

HERBICIDE (TRADE NAMES)	BARNYARDGRASS	CRABGRASS	FALL PANICUM	FOXTAILS	QUACKGRASS	COMMON LAMBSQUARTERS	COMMON PURSLANE	COMMON RAGWEED	GALINSOGA	MUSTARDS	NIGHTSHADES	PROSTRATE SPURGE	REDROOT PIGWEED	SMARTWEEDS	VELVETLEAF	YELLOW NUTSEDGE
ATRAZINE	G	F	P	G	G	E	E	E	G	E	E	G	E	E	F	F
ALANAP	P	P	P	P	P	G	F	F	F	F	P	P	G	G	G	P
BALAN	E	E	E	E	P	F	G	P	P	P	P	P	G	P	P	P
BLADEX/CYPRO	G	G	F	G	P	E	E	E	G	G	G	G	F	E	P	P
CAPAROL	F	G	F	F	P	E	G	G	F	G	G	G	E	F	F	P
COMMAND	G	G	G	G	P	G	E	G	G	F	P	F	P	F	E	P
CURBIT	E	E	E	E	P	G	G	P	P	F	F	P	G	G	P	P
DACTHAL	E	G	G	E	P	F	F	P	P	P	P	F	F	P	P	P
DEVRIKOL	E	E	E	E	P	P	G	P	P	P	P	P	G	P	P	P
DUAL	E	E	E	E	P	F	F	P	G	P	G	G	G	F	P	G
EPTAM	E	E	E	E	G	G	P	F	F	F	F	P	G	F	F	G
FRONTIER	E	E	E	E	N	P	G	P	—	F	G	G	G	F	N	G
GOAL	P	F	P	F	P	G	E	G	G	G	G	F	E	G	G	P
HARNESS/SURP	E	E	E	E	N	G	G	F	F	P	G	F	G	F	P	F
KARMEX/DIREX	E	F	F	E	P	E	E	E	G	G	G	F	E	E	F	P
KERB	F	F	P	F	G	F	G	F	P	P	P	F	P	F	P	P
LISSO	E	E	E	E	P	F	G	F	G	P	G	G	E	F	P	F
LOROX/LINEX	G	F	F	E	P	E	G	E	G	G	G	G	G	G	F	P
PERMIT	P	P	P	P	P	G	G	G	—	G	P	—	G	G	G	G
PREFAR	E	E	E	E	P	P	P	P	P	P	P	P	G	P	P	P
PROWL	E	E	E	E	P	G	F	P	F	P	P	G	G	F	F	P
PYRAMIN	F	F	F	F	P	E	G	G	P	G	G	F	G	G	P	P
RONEET	E	E	F	E	P	F	F	F	F	P	P	P	G	P	F	F
SENCOR	G	F	G	G	P	E	E	E	E	E	P	G	G	E	G	P
SINBAR	G	G	G	G	F	E	G	G	G	E	G	F	G	G	G	P
SOLICAM	E	E	E	E	F	F	F	G	G	E	F	G	F	G	F	F
SURFLAN	E	E	E	E	P	G	G	F	F	F	F	F	G	F	P	P
SUTAN	E	E	E	E	P	P	P	P	F	P	P	P	F	P	F	G
TILLAM	E	E	F	E	P	F	P	P	F	P	P	P	F	P	P	G
TREFLAN/TRILIN	E	E	E	E	P	F	F	P	P	P	P	P	G	P	P	P

E = Excellent, G = Good, F = Fair, P = Poor; — = insufficient data. Weed control will vary with soil type and weather.

Table 3. Effectiveness of Postemergence Herbicides on Weeds.

HERBICIDE (TRADE NAMES)	BARNYARDGRASS	CRABGRASS	FALL PANICUM	FOXTAILS	QUACKGRASS	COMMON LAMBSQUARTERS	COMMON PURSLANE	COMMON RAGWEED	GALINSOGA	MUSTARDS	NIGHTSHADES	PROSTRATE SPURGE	REDROOT PIGWEED	SMARTWEEDS	VELVETLEAF	YELLOW NUTSEDGE
ACCENT	E	P	E	E	G	F	—	P	—	—	P	—	E	G	F	F
ATRAZINE	G	G	F	G	G	E	E	E	G	E	G	G	E	E	G	G
BASAGRAN	P	P	P	P	P	G	G	G	G	G	F	P	P	E	G	G
BEACON	P	P	G	F	G	F	—	E	—	F	G	—	E	G	G	F
BLADEX	G	F	G	G	G	G	G	G	G	G	G	G	F	G	F	P
BUCTRIL	P	P	P	P	P	E	P	G	G	G	G	F	F	G	G	P
CAPAROL	F	F	F	F	P	E	G	E	G	G	G	G	E	F	F	P
2,4-D	P	P	P	P	P	E	P	E	G	G	E	E	E	E	F	P
GOAL	P	P	P	P	P	F	E	G	F	F	G	P	E	F	G	P
GRAMOXONE	E	E	E	E	E ¹	E	E	E	G	E	E	G	E	E	G	G ¹
LENTAGRAN	F	P	P	F	P	G	P	P	G	F	G	G	G	F	F	P
LOROX/LINEX	F	F	F	G	P	E	G	E	G	G	G	G	E	E	F	P
PERMIT	P	P	P	P	P	P	F	G	—	G	P	—	G	G	G	G
ROUNDUP	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F
SENCOR	F	F	F	G	P	E	E	E	E	E	P	G	G	E	G	P
SINBAR	F	P	F	P	P	E	E	G	G	E	G	G	G	G	F	P
SPINAID	P	P	P	P	P	G	G	G	G	G	F	F	P	G	P	P
STINGER	P	P	P	P	P	P	P	G	G	P	P	P	P	F	P	P

E = Excellent, G = Good, F = Fair, P = Poor; — = insufficient data. Weed control will vary with soil type and weather.

¹Kills top growth only.

WEED CONTROL RECOMMENDATIONS FOR VEGETABLE CROPS

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
ASPARAGUS (Seed beds for crown production)	Preemergence annuals	terbacil (SINBAR 80W)	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 of 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.
	Emerged annuals	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply after weeds emerge, but before asparagus emerges. Include 1 pt NIS per 100 gal of spray mix.
	Pre- or postemergence broadleaves	linuron (LOROX 50DF) (LINEX 50DF)	0.5—1.5	1—3 lb	MICHIGAN, MINNESOTA only. PREEMERGENCE: Plant seed 1-1.5 inches deep; spray a 1 inch band of activated charcoal over the rows at a rate of 300 lb per acre of actual area sprayed (15 lb per acre with 20 inch rows). Broadcast 2 lb of Lorox (1 lb ai) over the field. POSTEMERGENCE: When fern is 6-18 inches high and weeds are not over 4 inches high, broadcast 1-2 lb Lorox (½-1 lb ai). Do not exceed a total of 2 lb ai per acre per year.
ASPARAGUS (Newly planted crowns)	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.38	1—2 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum 5 pt/a/yr and 2 applications.
	Germinating or emerged broadleaves	fluzifop-P (FUSILADE DX 2E)	0.25—0.38	1—1.5 pt	Apply to nonbearing asparagus only. Include 1 qt COC or 1 pt nonionic surfactant per acre. Use high rate on quackgrass.
		linuron (LOROX 50 DF) (LINEX 50 DF)	1—2	2—4 lb	MICHIGAN, MINNESOTA only. PREEMERGENCE: Broadcast 2-4 lb Lorox (1-2 lb ai) before crop emergence. POSTEMERGENCE: When fern is 6-18 inches high and weeds are not over 4 inches high, broadcast 2 lb Lorox (1 lb ai). Do not exceed a total of 2 lb ai per acre per year.
ASPARAGUS (Established one year or more)	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.38	1—2 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum 5 pt/a/yr and 2 applications.
	Emerged annuals	fluzifop-P (FUSILADE DX 2E)	0.25—0.38	1—1.5 pt	Apply to nonbearing asparagus only. Include 1 qt COC or 1 pt nonionic surfactant per acre. Use high rate on quackgrass.
		paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before crop emergence or after the last harvest. Include 1 pt NIS per 100 gal. 6 day PHI. RUP.

Germinating annuals	diuron (KARMEX 80DF) (DIREX 80DF)	2—3	2.5—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 ai/a/yr. 6-8 weeks residual activity.
	norflurazon (SOLICAM 80DF)	2—4	2.5—5 lb	Apply in fall after chopping fern or in spring before emergence. Use lower rate on coarse, sandy soil. Apply only once per season. Gives 3-4 months residual activity. Suppresses nutsedge.
	metribuzin (SENCOR 75DF)	1—2	1.3—2.6 lb	Apply after tillage or chopping fern in the spring and again after the harvest season, if necessary. Apply before weeds emerge. Do not exceed 2 lb ai/acre/year. Two applications give good season-long sandbur control. 6-8 weeks residual activity. 14 day PHI.
	terbacil (SINBAR 80W)	1.2—2	1.5—2.5 lb	Apply before spears emerge. Use lower rate on sandy soils. Maximum of 3 lb product and 2 applications per year. Do not plant other crops within 2 years of last application. 5 day PHI.
Germinating grasses	napropamide (DEVRINOL 50DF)	4	8 lb	Apply before emergence in the spring and incorporate 1-2 inches. Gives good grass control. 4-6 weeks residual activity.
	trifluralin (TREFLAN 4E) (TRILIN 4E)	1—1.5	1—1.5 qt	Use higher rate on heavier soils. Apply and incorporate 1-2 inches early in the spring when spears are at least 4 inches below the soil surface. Gives good grass control. 4-6 weeks residual activity.
Emerged broadleaves	linuron (LOROX 50DF) (LINEX 50DF)	1—2	2—4 lb	MICHIGAN, MINNESOTA only. Apply before or after crop emergence. Use high rate preemergence. Do not exceed 4 lb ai/acre/year. 6 weeks residual activity. 1 day PHI.
	2,4-D amine salts (FORMULA 40) (4 lb/gal)	2	2 qt	Apply before, during, or after the harvest season when weeds are growing rapidly. During harvest, spray soon after a pick to minimize crop injury. In fern, use drop nozzles. 3 day PHI.
	clopyralid (STINGER 3L)	0.188—0.25	8—11 fl oz	Apply before or during harvest in 10-20 gpa. Apply to young annuals or perennials before bud stage. Controls dandelion, Canada thistle, horseweed, plantain, smartweed. May cause crooking of some spears. 12 hr PHI.
	dicamba (CLARITY 4L) (BANVEL 4L)	0.25—0.5	0.5—1 pt	Apply to actively growing weeds immediately after a harvest. Use high rate for control of perennial weeds. Apply in tank mix with 2,4-D, or glyphosate for control of Canada thistle or field bindweed. Discard crooked spears at harvest. Do not exceed 1 pt/a/yr. 24 hr PHI.
Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.38	1—2 pt	Apply to actively growing grasses. Include 1 qt COC in 20 gal water per acre. Maximum 5 pt and 2 applications per year. 1 day PHI.
Emerged perennials, quackgrass, volunteer asparagus	glyphosate (ROUNDUP) (4 lb/gal)	1—4	1—4 qt	Use lowest rate for annuals and higher rates for perennials. Include 1 pt NIS per acre. PRIOR TO CROP EMERGENCE, for control of emerged annuals and perennials. Apply at least 7 days before asparagus emergence. SPOT TREATMENT: Apply immediately after a clean harvest. Do not treat more than 10% of total field area to be harvested. 5 day PHI. POST HARVEST: Apply immediately after the last harvest and all spears have been removed. If spears regrow before application, allow fern to develop and apply as a shielded or directed spray. Do not allow herbicide to contact emerged spears or fern.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
BEANS (Snap, Lima)	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before or after seeding but before crop emergence. Include 1 pt NIS per 100 gal. RUP.
	Emerged quackgrass	glyphosate (ROUNDUP 4 lb/gal)	2	2 qt	Apply to 8-10-inch quackgrass in the fall or spring prior to planting. Allow at least 5 days before plowing. Include 1 pt NIS/a.
	Germinating grasses and some broadleaves	EPTC (EPTAM 7E)	3	3.5 pt	SNAP BEANS only. Apply before planting and incorporate 2-4 inches immediately. For dry conditions.
		pendimethalin (PROWL 3.3E)	1—1.5	1.2—1.8 qt	Apply before planting and incorp. 1-2 inches deep. Use high rate on soils with 3% or more organic matter.
		s-metolachlor (DUAL MAGNUM 7.6E)	0.95—1.9	1—2 pt	Use lower rate on sandy soils with less than 3% organic matter. Incorp. 1-2 inches before planting, or apply preemergence.
		trifluralin (TREFLAN 4E)	0.5—0.75	1—1.5 pt	Apply before planting. Incorporate into soil 2-3 inches soon after spraying. Use lowest rate on sandy soils. Does not control ragweed.
	Germinating broadleaves	imazethapyr (PURSUIT 2L)	0.031—0.047	2—3 fl oz	LIMA BEANS ONLY. Apply PPI or PRE after seeding. Use low rate on sandy soils. Do not apply after June 30. 30 day PHI. OBSERVE CROP ROTATION RESTRICTIONS. PURSUIT MAY CAUSE SEVERE CARRYOVER INJURY.
	Postemergence grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Dry and succulent beans. Apply to actively growing grasses. Maximum of 4 pt/a/yr. Add 1 qt COC/a. 15 day PHI for succulent beans and 30 days for dry beans.
		quizalofop (ASSURE II) (0.88 lb/gal)	0.04—0.08	6—12 fl oz	SNAP BEANS only. Apply to actively growing grasses in 10-20 gpa. Include 1% COC or .25% NIS. 30 day PHI.
	Emerged annuals, yellow nutsedge	bentazon (BASAGRAN) (4 lb/gal)	0.75—1	0.75—1 qt	Apply after beans have more than 1 expanded trifoliolate leaf to prevent crop injury. Two applications are needed for nutsedge and Canada thistle control. Do not apply more than 2 qt/acre/year.
BEETS, RED	Germinating and emerged broadleaves	pyrazon (PYRAMIN 68DF)	3.1—3.7	4.6—5.4 lb	Apply from planting until weeds are 2 inches high. On muck soils, better control is obtained by spraying small weeds after beets have two true leaves. Include 1 qt COC per acre.
	Germinating annuals	cycloate (RO-NEET 6E)	3—4	2—3 qt	Apply before planting. Incorporate 2-3 inches after spraying. Use lowest rate on sandy soils. Not effective on muck soils.
	Emerged broadleaves	phenmedipham (SPIN-AID 1.3E)	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 PHI.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Use high rate on perennial grasses. Maximum of 3 pt/a/yr. Include 1 qt COC/a. 60 day PHI.
Emerged annuals and perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	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 weed. Include 1 pt NIS/a.	

BROCCOLI, BRUSSELS SPROUTS, CABBAGE, CAULIFLOWER (Seeded or transplanted)	Emerging weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before transplanting or before or after seeding, but before crop emergence. Include 1 pt NIS per 100 gal. RUP.
	Germinating grasses and broadleaves	trifluralin (TREFLAN 4E) (TRILIN 4E)	0.5—1	1—2 pt	Apply before seeding or transplanting. Incorporate 2-3 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. Trifluralin may stunt transplanted crops or delay emergence of seeded crops when soil temperature is below 60° F.
		napropamide (DEVINOL 50DF)	1—2	2—4 lb	Apply before seeding or transplanting and incorporate 1-2 inches. May be applied after planting. Irrigate within 24 hours and soak soil 2-4 inches. Most effective in combination with Goal.
		s-metolachlor (DUAL MAGNUM 7.6E)	0.48—1.2	0.5—1.3 pt	KY, MI, WI—TRANSPLANTED CABBAGE only. Apply to soil surface before or after transplanting. Do not tank mix with Goal. For use only by members of Wisconsin Kraut Growers Assoc., Kentucky Veg. Growers Assoc., and Michigan Veg. Council.
	clomazone (COMMAND 4E)	0.25—0.5	0.5—1 pt	KY, MI, OH, WI. CABBAGE only. Apply and incorporate 1 inch before seeding or transplanting. May cause early stunting or discoloration of cabbage. Good control of velvetleaf. Observe rotational restrictions. 45 day PHI.	
	oxyfluorfen (GOAL 2XL)	0.25—0.5	1—2 pt	TRANSPLANTED only. Apply to soil after final tillage but before transplanting. Do not apply after transplanting. Do not use on direct seeded cole crops. Use low rate on coarse, sandy soil. If plants contact treated soil, some foliar burn may occur, but plants generally outgrow the symptoms rapidly. Do not use on Brussels Sprouts. Use with trifluralin or napropamide.	
	pyridate (LENTAGRAN 45WP)	0.90	2 lb	CABBAGE only. Apply after cabbage is well established after transplanting or has 3 fully developed leaves after seeding. Will cause some yellowing of cabbage leaves. 45 day PHI.	
	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Use high rate on perennial grasses. Maximum of 3 pt/a/yr. Include 1 qt COC/a. 30 day PHI.	
	Postemergence shielded application emerged weeds	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.5	1.5 pt	OHIO—CABBAGE: Use shields to protect crop. Apply in 20-30 gal/acre water. Do not exceed 30 PSI pressure. Do not allow spray to contact crop foliage. Maximum of 3 applications.
	Perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	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 weed. Include 1 pt NIS per acre.
CHINESE VEGETABLES	Preemergence grasses and broadleaves	bensulfide (PREFAR 4E)	5—6	5—6 qt	Apply preplant or preemerge. Incorporate or water in. See label for crops included.
	Postemergence grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 qt	Chinese cabbage (bok choy, napa) and Chinese broccoli (gai lan). Apply to actively growing grasses. Include 1 qt COC/acre. Maximum 3 pt/a/yr. 30 day PHI.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
CARROT	Germinating annuals	linuron (LOROX 50DF)	0.5—1	1—2 lb	PREEMERGENCE: MICHIGAN, OHIO, WISCONSIN only. Apply after seeding but before carrots emerge. Use low rate on light soils, and increase rate on soil containing more clay or organic matter.
		trifluralin	0.5—1	1—2 pt	Mineral soil only. Apply before planting and incorporate 2-3 inches soon after spraying. Use low rate on sandy soils.
	Emerged broadleaves	linuron (LOROX 50DF) (LINEX 50DF)	0.75—1	1.5—2 lb	POSTEMERGENCE: ALL AREAS. Broadcast after carrots are 3 inches high. Do not apply when temperature is above 85°F. Do not apply at pressure above 40 PSI. Do not mix with other pesticides or surfactants. Do not apply within 14 days of any other pesticides when carrots are under stress. Do not apply more than once per season if carrots are rotated with onions. Gives fair control of pineappleweed, maretail, and groundsel. 60 day PHI.
		metribuzin (SENCOR 75DF)	0.25	0.33 lb	Broadcast when carrots have 5-6 leaves. Do not apply during cool cloudy weather, or when temperature is above 85°F. Do not mix with other chemicals. Do not apply within 14 days of any other pesticides when carrots are under stress. Do not apply more than once per season if carrots are rotated with onions. Gives fair control of pineappleweed, maretail, and groundsel. 60 day PHI.
	Emerged grasses	fluazifop-P (FUSILADE DX 2E)	0.16—0.19	10—12 fl oz	Apply to actively growing grasses. Do not apply more than 6 pt/acre/year. Include 1 qt COC or 1 pt NIS/a. 45 day PHI.
		sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 5 pt maximum total per acre. 30 day PHI.
	Perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	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 weed. Include 1 pt NIS/a.
CELERY (Transplanted)	Germinating grasses, yellow nutsedge	s-metolachlor (DUAL MAGNUM 7.6E)	0.95—1.9	1—2 pt	MI only. Apply before or immediately after transplanting. Use high rate on muck soils. Follow with 0.25 inch water within 7 days. For use by members of Michigan Vegetable Council only.
	Germinating or emerged annuals	prometryn	1—2	1—2 qt	Make 1 application 2-6 weeks after transplanting but before weeds are 2 inches tall. Do not exceed 2 lb ai/acre/year.
		linuron (LOROX 50DF) (LINEX 50DF)	0.75—1	1.5—2 lb	Apply after transplanting but before celery is 8 inches tall. Do not exceed 40 PSI pressure. Do not apply when temperatures exceed 85°F and do not mix with wetting agents or other pesticides.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt/acre/season. 30 day PHI.
	Perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt nonionic surfactant per acre.
CORN (Sweet, Pop)	Emerged annuals	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.5—1	1.5—3 pt	Apply before or after planting but before corn emerges to kill emerged weeds. RUP.

Preemergence	atrazine (AATREX 4L)	1—2	1—2 qt	Apply after planting but before weeds are 1 inch tall. Do not plant any crop but corn for 18 months on land treated with more than 1 lb ai of atrazine. Use with a PRE grass herbicide. RUP.
	cyazifluthrin (BLADEX 4L) (CYPRO 4L)	1—4	1—4 qt	Apply after planting. Use with a PRE grass herbicide. Some supersweet corn (sh2) may be sensitive to Bladex. Do not apply POST on pop or sweet corn. RUP.
	alachlor (LASSO 4E)	2—4	2—4 qt	Apply soon after planting and before weeds emerge. Controls primarily grasses. RUP.
	s-metolachlor (DUAL MAGNUM 7.6E)	1.2—1.9	1.3—2 pt	Apply soon after planting and before weeds emerge. Controls primarily grasses. Some nutsedge activity.
	acetachlor (SURPASS 6.4EC) (HARNESS + 7E)	0.8—3	1—3.75 pt 0.9—3.4 pt	POPCORN only. May be preplant incorporated or applied to surface after planting. Check label for rate for soil type. Controls many broadleaves and grasses. RUP.
	dimethenamid (FRONTIER 6EC)	0.75—1.5	1—2 pt	Apply PPI or PRE. Check label for rate for soil type. Some popcorn varieties may be sensitive. Controls many broadleaves and grasses.
	EPTC (ERADICANE EXTRA 6E)	4—6	2.7—4 qt	Incorporate 2-3 inches immediately after application. Not effective on organic soils. Suppresses quackgrass and nutsedge. Controls primarily grasses.
	butylate (SUTAN + 6.7E)	4—6	2.5—3.5 qt	Incorporate 2-3 inches immediately after application. Suppresses annual grasses and nutsedge.
	pendimethalin (PROWL 3.3E) (PENTAGON 60 DG)	1—2	1.2—2.4 qt 1.2—3.3 lb	SWEET CORN only. IL, MN, WI only. Apply soon after planting. Do not incorporate. Controls many broadleaves and grasses, including wild proso millet. Processing corn only.
	2,4-D (WEEDAR 64 4L)	0.5	1 pt	SWEET CORN only. Apply after corn and weeds emerge and before corn is 8 inches tall. Avoid drift to other crops. Check label of other 2,4-D formulations for use on sweet or pop corn. 2,4-D may injure some supersweet (Sh2, SE) cultivars.
Postemergence broadleaves	bentazon (BASAGRAN 4L)	0.75—1	1.5—2 pt	Apply when weeds are small. Apply twice for nutsedge control. Include 1 qt COC per acre.
	bromoxynil (BUCTRIL 2E)	0.25—0.375	1—1.5 pt	POPCORN only. Apply prior to tasseling of corn. Controls only broadleaves. 30 day PHI.
	halosulfuron (PERMIT 75WSG)	0.032	0.67 oz	Apply as broadcast or directed spray to corn from spike to layby stage. If needed, apply a second application as a directed spray. Include 0.5% NIS. Do not apply to Jubilee sweet corn, or any corn under stress. Controls nutsedge. Observe rotational restrictions.
Postemergence grasses and broadleaves	primisulfuron (BEACON 75 DG)	0.036	0.76 oz	POPCORN only. Apply to corn 4-20 inches or taller. Beacon may injure popcorn. Controls many broadleaves and some grasses. Add 0.25% NIS or 1% COC. 60 day PHI.
	nicosulfuron (ACCENT 75 SP)	0.031	0.67 oz	POPCORN only. Apply to corn up to 20 inches tall. Accent may injure popcorn. Controls many grasses and some broadleaves. Add 0.25% NIS or 1% COC.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
CUCUMBER (Pickling, Slicing)	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before seeding or transplanting cucumbers to kill emerged weeds. Include 1 pt NIS per 100 gal. RUP.
	Germinating annuals	ethafluralin (CURBIT 3E)	0.75—1.13	2—3 pt	DIRECT SEEDED CUCUMBERS. Use low rate on light, sandy soil. Apply to soil surface within 2 days of seeding. Do not incorporate. Needs .5 inch of water within 5 days to activate it. If no rain, cultivate shallowly. Heavy rainfall may result in crop injury. TRANSPLANTED CUCUMBERS. Apply to soil between rows of plastic mulch. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over the top of transplants.
		bensulide (PREFAR 4E)	4—6	4—6 qt	Apply and incorporate 0.5-1 inch before seeding or transplanting. Controls many annual grasses. May stunt crop if used under clear plastic. Usually used in tank mix with Alanap.
		naptalam (ALANAP 2L)	3—4	6—8 qt	PREEMERGENCE: Apply and incorporate before seeding or apply soon after seeding. Apply to moist soil or water in. Tank mix with Prefar or Command. May be used under clear plastic. POSTEMERGENCE: Apply after transplanting, or just before cucumbers vine out. Controls several broadleaves.
		trifluralin (TREFLAN 4E)	0.5—1	1—2 pt	Direct the spray between rows of plants with 3-4 leaves. Cultivate shallowly to incorporate. Avoid contact with crop leaves.
		clomazone (COMMAND 4E)	0.25—0.375	8—12 fl oz	Ml, OH. Apply and incorporate 1 inch or less before seeding. If replanting after poor stand, do not reapply Command. Good control of velvetleaf. Observe rotational restrictions. 45 day PHI.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt per acre per season. 14 day PHI.
	Emerged weeds	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	.5	1.5 pt	MICHIGAN AND OHIO only. Use shields to protect crop. Apply in 20-30 gal/acre water. Do not exceed 30 PSI pressure. Do not allow spray to contact crop foliage. Maximum 3 applications per year.
	Emerged perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Check label for correct rate for each weed. Include 1 pt NIS per acre.
EGGPLANT	Emerged annuals	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before transplanting or as a directed spray postemergence. Include 1 pt NIS/100 gal. Do not exceed 30 PSI. RUP.
	Germinating annuals	trifluralin (TRILIN 4E)	0.5—1	1—2 pt	Incorporate before transplanting.
		napropamide (DEVIRINOL 50DF)	1—2	2—4 lb	Apply before transplanting. Incorporate 1-2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 4.5 pt/acre/season. 20 day PHI.
	Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Include 1 pt NIS per acre.

ENDIVE, ESCAROLE, CHICORY	Germinating annuals	pronamide (KERB 50W)	1—1.5	2—3 lb	Apply before or after seeding and before weeds emerge. Must be incorporated or irrigated into soil. Can be applied postemergence to crop. Weed control will be marginal on muck soil. 55 day PHI. RUP.
		trifluralin	0.5—1	1—2 pt	Endive, escarole, chicory, radicchio, Belgian endive. Incorporate before seeding.
		bensulide (PREFAR 4E)	5—6	5—6 qt	Apply preplant and incorporate or preemerge and water in. Endive, Florence fennel, radicchio.
	Postemergence grasses	fluzifop-P (FUSILADE DX 2E)	0.16—0.19	10—12 fl oz	Apply to actively growing grasses. Maximum of 6 pt/acre. Include 1 qt COC or 1 pt nonionic surfactant per acre. 28 day PHI.
		sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt/acre/season. 15 day PHI.
	Perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	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 weed. Include 1 pt NIS/a.
	Emerging weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before or after planting but before crop emerges. Include 1 pt NIS per 100 gal. Will kill small grains planted for windbreak and any emerged crop plants. 60 day PHI. RUP.
	Germinating annuals	pendimethalin (PROWL 3.3E)	0.5—1.5	1.2—3.6 pt	Apply preemergence or postemergence at the 1-5 leaf stage. Follow with rainfall or irrigation within 7 days. Max. 3.6 pt/a/yr. 45 day PHI.
		bensulide (PREFAR 4E)	5—6	5—6 qt	Apply preplant or preemerge. Incorporate or water in. Not effective on high organic soils.
		bromoxynil (BUCTRIL 2E)	0.5—1	1—2 qt	Apply after garlic emerges but before it is 12 inches high. Do not apply within 112 days of anticipated harvest. RUP.
GARLIC	Emerging grasses	fluzifop-P (FUSILADE DX 2E)	0.16—0.19	10—12 fl oz	Apply to actively growing grasses. Maximum of 6 pt/acre. Include 1 qt COC or 1 pt nonionic surfactant per acre. 45 day PHI.
		sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 4.5 pt maximum total per acre. 30 day PHI.
		clethodim (SELECT 2E)	0.1—0.25	6—16 fl oz	Apply to actively growing grasses. Include 1% COC in spray mix. Use high rate for perennial grasses and annual bluegrass. Maximum of 68 fl oz/a/yr. 45 day PHI.
	Emerging perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Include 1 pt NIS per acre.
	Germinating broadleaves	oxyfluorfen (GOAL 2XL)	0.5	2 pt	Apply to established plantings or new plantings before plants emerge. Mix trash into soil before application.
	Perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.
HORSE RADISH	Emerging grasses	sethoxydim (POAST 1.5E)	0.19—0.47	1—2.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum of 5 pt/a/yr. 60 day PHI.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
LEEK	Postemergence grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 pt COC/a. 4.5 pt maximum total/acre. 30 day PHI.
	Perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.
LETTUCE (Head, leaf)	Emerged annuals	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.3—1	1—3 pt	PREEMERGENCE: Apply before or after seeding but before lettuce emerges. Include 1 pt NIS/100 gal. MI AND OH. POSTEMERGENCE SHIELDED SPRAY: Apply 1-1.5 pt/a to weeds 1-6 in. tall. Shield lettuce completely and apply to space between rows. RUP.
	Germinating annuals	pronamide (KERB 50W)	1—2	2—4 lb	Apply before or after seeding but before weeds emerge. Must be incorporated or irrigated into the soil. Can be applied postemergence to lettuce. Use high rate on muck soil. MICHIGAN AND OHIO only. Use 4-6 lb ai (8-12 lb of product) to improve weed control on muck soil. 55 day PHI. RUP.
		benefin (BALAN 60DF)	1.2—1.5	2—2.5 lb	Apply before planting. Incorporate 2-3 inches immediately after spraying. Not effective on muck soils.
		bensulide (PREFAR 4E)	5—6	5—6 qt	Apply preplant and incorporate or preemerge and water in. Not effective on muck soil.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt/a COC. Max. 3 pt/a/yr. Head lettuce: 30 day PHI; leaf lettuce: 15 day PHI.
	Perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.
MINT	Germinating annuals	terbacil (SINBAR 80W)	0.4—1.6	0.5—2 lb	PREEMERGENCE: Apply in spring before mint emerges. POSTEMERGENCE: Apply up to 1 lb product plus 1 pt NIS/a. Max. of 2 lb product/a/yr. Carryover injury to other crops. 60 day PHI.
	Germinating broadleaves	oxyfluorfen (GOAL 2XL)	0.5	1 qt	INDIANA, MICHIGAN, WISCONSIN only. Apply before mint emerges to avoid crop injury. May cause temporary stunting of mint.
	Emerged broadleaves	bentazon (BASAGRAN 4L)	1	1 qt	Apply postemergence when weeds are small. Include 1 qt COC per acre. Do not exceed 4 lb/acre/year.
		bromoxynil (BUCTRIL 2E)	0.25	1 pt	Apply during dry weather with temperatures below 70°F. Effective on small weeds. May cause temporary stunting and leaf chlorosis of mint. 70 day PHI.
		clopyralid (STINGER 3L)	0.188—0.375	.5—1 pt	Apply up to 1 pt in fall or 0.5 pt in spring. Max. of 1 pt/a/yr. Controls composites (eg. Canada thistle, dandelion), legumes, smartweeds, nightshades, plantains, and some other weeds. 45 day PHI.
		glyphosate (ROUNDUP ULTRA 4L)	1—3	1—3 qt	Use as a spot spray to kill perennials. Mint sprayed will be killed. Treat a max. of 1/10 of any acre. 7 day PHI.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum 5 pt and 2 applications/year. 20 day PHI.
		quizalofop (ASSURE II 0.88E)	0.04—0.07	6—10 fl oz	Apply in 10-40 gal/a to actively growing grass. Use high rate on perennial grass. Include 1% COC or .25% NIS/a. 30 day PHI.

MUSKMELON		paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before seeding or transplanting melons to kill emerged weeds. Include 1 pt NIS per 100 gal. RUP.
Emerging weeds before crop emergence					
Germinating broadleaves and grasses	ethafluralin (CURBIT 3E)	0.75—1.13	2—3 pt	DIRECT SEEDED MELONS. Use low rate on light, sandy soil. Apply to soil surface within 2 days of seeding. Do not incorporate. Needs .5 inch of rain or irrigation within 5 days to activate it. If no rain occurs, cultivate shallowly. Heavy rainfall after application may cause crop injury. TRANSPLANTED MELONS. Apply as a banded spray to soil between rows of plastic mulch. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over the top of transplants.	
	bensulide (PREFAR 4E)	4—6	4—6 qt	Apply and incorporate 0.5-1 inch before seeding or transplanting. Controls many annual grasses. May stunt crop if used under clear plastic. Usually used in tank mix with Alanap.	
	naptalam (ALANAP 2L)	3—4	6—8 qt	PREEMERGENCE: Apply and incorporate before seeding or apply soon after seeding. Apply to moist soil or water in. Usually used in tank mix with Prefar. May be used under clear plastic. POSTEMERGENCE: Apply after transplanting, or just before melons vine out. Controls several broadleaves.	
Emerging grasses	trifluralin (TREFLAN 4E)	0.5—1	1—2 pt	Direct the spray between rows when plants have 3-4 leaves. Cultivate shallowly to incorporate. Avoid contact with crop leaves.	
	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt/acre/season. 14 day PHI.	
Postemergence shielded emerged weeds	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	.5	1.5 pt	MICHIGAN AND OHIO only. Use shields to protect crop. Apply in 20-30 gal/acre water. Do not exceed 30 PSI pressure. Do not allow spray to contact crop foliage. Maximum 3 applications/yr. RUP.	
Emerging perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Include 1 pt NIS/a.	
Emerging weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	COLLARDS AND TURNIPS. Apply before or after seeding but before crop emergence. Include 1 pt NIS/100 gal. RUP.	
Germinating annuals	bensulide (PREFAR 4E)	5—6	5—6 qt	Apply preplant or preemerge and water in. Not effective on muck soils.	
	trifluralin (TREFLAN 4E)	0.5—0.75	1—1.5 pt	Apply before planting. Incorporate 2-3 inches into soil soon after spraying. Use low rate on sandy soils. Not effective on muck.	
Postemergence grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	COLLARD, KALE, KOHLRABI, MUSTARD, RAPE GREENS. Apply to actively growing grasses. Include 1 pt COC per acre. 3 pt maximum total/acre. 30 day PHI.	
Perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.	

**MUSTARD,
COLLARDS,
KALE,
KOHLRABI,
TURNIP
GREENS**

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
OKRA (Seeded or transplanted)	Germinating annuals	trifluralin	0.5—1	1—2 pt	Apply before planting. Incorporate 2-3 inches into soil immediately after spraying.
	Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting or after harvest. Include 1 pt NIS/a.
ONION, SHALLOT, DRY BULB Seeded sets, transplants	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before or after seeding but before crop emerges. Include 1 pt NIS per 100 gal. Kills small grains planted for windbreak and any emerged crop plants. 60 day PHI. RUP.
	Germinating annuals	pendimethalin (PROWL 3.3EC) (PENTAGON 60DG)	0.5—2	0.6—2.4 qt 0.8—3.3 lb	MUCK SOIL: Apply 2-2.4 qt/a preemergence or at transplanting and after the 2 leaf stage. Make third application at the 6-9 leaf stage. Pack soil well over the row. Wait 5 days after interseeding barley before applying. Max. 7.2 qt/a/yr. MINERAL SOIL: Apply 1.2-3.6 pt/a when onions have 2-9 leaves. Max. 3.6 pt/a/yr. 45 day PHI.
	Germinating annuals, yellow nutsedge	s-metolachlor (DUAL MAGNUM 7.6E)	0.63—1.2	.67—1.3 pt	MI only. Apply after 2 leaf stage of onions. On muck soils make a second application 3-4 weeks after first. For use by members of Michigan Vegetable Council only. 60 day PHI.
	Emerged broadleaves	oxyfluorfen (GOAL 2XL)	0.031—0.063	2—4 fl oz	Apply as a broadcast spray after onions have 2 true leaves. Spray during sunny, warm weather. Apply 8 fl oz to kill large weeds. Do not exceed 2 pt/acre/year. 45 day PHI.
		bromoxynil (BUCTRIL 2E)	0.13—0.25	0.5—1 pt	Apply before onions emerge or to onions with 2-5 leaves. Application to younger or older onions may cause crop injury. Apply in a minimum of 50 gal/a water, after 2 sunny days, when soil and onion leaves are dry, and temperature is 70-80°F to avoid crop injury. Controls mustards, lambsquarters, and smartweed.
	Emerged grasses	fluzifop-P (FUSILADE DX 2E)	0.16—0.19	10—12 fl oz	Apply to small, actively growing grasses. Include 1 qt COC or 1 pt nonionic surfactant per acre. 45 day PHI.
		sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 4.5 pt maximum total per acre. 30 day PHI.
		clethodim (SELECT 2E)	0.1—0.25	6—16 fl oz	Apply to actively growing grasses. Include 1% COC in spray mix. Use high rate for perennial grasses and annual bluegrass. Maximum of 0.5 lb/a/yr. 45 day PHI.
	Perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.
ONION, GREEN	Germinating annuals	DCPA (DACTHAL 75W)	6—10.5	8—14 lb	MINERAL SOIL only. Apply after planting or after a clean cultivation to moist soil, or follow with .25 inch rain or irrigation. Use higher rate on heavier, darker soils.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 4.5 pt maximum total per acre. 30 day PHI.

PARSLEY	Germinating annuals	linuron (LOROX 50DF) (LINEX 50DF)	0.75—1	1.5—2 lb	STATES EAST OF MISSISSIPPI RIVER only. Mineral and muck soil: Apply after seeding but before crop emergence. MUCK SOIL: One additional postemergence application at 0.5 lb ai/a. 30 day PHI.
		bensulide (PREFAR 4E)	5—6	5—6 qt	Apply preplant or preemergence. Incorporate or water in. Not effective on muck soil.
	Perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	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 weed. Include 1 pt NIS/a.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 3 pt maximum total per acre. 15 day PHI.
PARSNIP	Germinating annuals	linuron (LOROX 50DF) (LINEX 50DF)	1—2	2—4 lb	Apply before parsnips emerge and again after they are 4 inches tall. Do not apply when temperatures exceed 85°F. Do not exceed 40 PSI.
	Perennials and annuals	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting or after harvest. Include 1 pt NIS/a.
PEAS	Quackgrass	glyphosate (ROUNDUP 4L)	2	2 qt	Apply to 8-10 inch tall quackgrass in the fall or spring prior to planting. Include 1 pt NIS/a. Wait 5 days before plowing.
	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before or after seeding but before crop emergence. Include 1 pt NIS per 100 gal. RUP.
	Germinating grasses and broadleaves	trifluralin (TREFLAN 4E)	0.5—0.75	1—1.5 pt	Apply before planting. Incorporate 2-3 inches soon after spraying. Use lower rate on early plantings on sandy soils.
		s-metolachlor (DUAL MAGNUM 7.6E)	0.95—1.9	1—2 pt	Use lower rate on sandy soils with less than 3% organic matter. Apply preemergence only. Do not incorporate on English peas.
		clomazone (COMMAND 4E)	0.5	1 pt	Apply and incorporate 2-3 inches before planting. Use in combination with other herbicides to broaden weed control spectrum. Cover crops planted after pea harvest may suffer some stand reduction.
	Germinating or emerged broadleaves	imazethapyr (PURSUIT 2L)	.047	3 fl oz	Apply PPI or PRE. Do not apply to peas treated with Treflan. POSTEMERGENCE: Apply 2-3 fl oz after 1 true leaf stage. Include 1 pt NIS/50 gal water. 30 day PHI. OBSERVE CROP ROTATION RESTRICTIONS. PURSUIT MAY CAUSE CARRYOVER INJURY.
	Canada thistle and broadleaves	MCPB (THISTROL) (2 lb/gal)	0.5—1	1—2 qt	Apply when peas have developed 6-12 nodes. Do not apply later than 3 nodes before pea flowering or yields may be reduced. Do not apply when peas are under stress or when temp. exceeds 90°F.
	Emerged annuals, nutsedge	bentazon (BASAGRAN) (4 lb/gal)	0.75—1	0.75—1 qt	Apply after peas have 3 pairs of leaves. Two applications are needed for nutsedge and Canada thistle control. Do not exceed 2 lb/ai/a/yr. Do not add COC on peas. 30 day PHI.
	Postemergence grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Dry and succulent peas. Apply to actively growing grasses. Use high rate on perennial grasses. Max. 4 pt/a/yr. Include 1 qt COC/a. 15 day PHI for succulent peas and 30 days for dry peas.
		quizalofop (ASSURE II 0.88 L)	0.04—0.08	6—12 fl oz	Apply to actively growing grasses in 10-20 gpa. Include 1% COC or 0.25% NIS. 30 day PHI.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
PEAS (Southern)	Germinating annuals	s-metolachlor (DUAL MAGNUM 7.6E)	0.95—1.9	1—2 pt	Use low rates on soils with less than 3% organic matter. Incorporate rate 1-2 inches before planting, or apply to soil after planting.
		trifluralin	0.5—1	1—2 pt	Apply before planting and incorporate 2-3 inches. Use lower rate on sandy soils.
	Germinating or emerged broadleaves	imazethapyr (PURSUIT 2L)	0.063	4 fl oz	Apply PPI or PRE after seeding. POSTEMERGENCE: Apply when southern peas are at least 3 inches high. Include 1 pt NIS/50 gal water. 30 day PHI. OBSERVE CROP ROTATION RESTRICTIONS. PURSUIT MAY CAUSE SEVERE CARRYOVER INJURY.
	Emerged annuals, nutsedge	bentazon (BASAGRAN) (4 lb/gal)	0.75—1	0.75—1 qt	Apply after peas have 3 pairs of leaves to prevent injury. Two applications are needed for nutsedge and Canada thistle control. Do not apply more than 2 lb ai/acre/year. Do not add COC on peas.
Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting or after harvest. Include 1 pt NIS/a.	
Postemergence grasses	sethoxydim (POAST 1.5E)	.19—.28	1—1.5 pt	Use on all dry and succulent peas. Apply to actively growing grasses. Max. 4 pt/a/yr. Include 1 qt COC/a. 15 day PHI for succulent peas and 30 days for dry peas.	

PEPPER (Transplanted)	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before transplanting or before or after seeding but before crop emergence. Include 1 pt NIS per 100 gal. RUP.
	Germinating annuals	napropamide (DEVRINOL 50DF)	1—2	2—4 lb	Apply before planting. Incorporate 1-2 inches. Use lower rate on coarse, sandy soils and higher rate on heavy, clay soils.
		trifluralin	0.5—1	1—2 pt	Apply before transplanting. Incorporate 2-3 inches soon after application. Use lower rate on sandy soils.
		clomazone (COMMAND 4E)	0.5—1	1—2 pt	ALL PEPPERS EXCEPT BANANA. Apply and incorporate 1 inch before planting. Set plant roots below herbicide.
		s-metolachlor (DUAL MAGNUM 7.6E)	0.48—0.95	0.5—1 pt	KY and MI only. Bell peppers only. Apply to soil surface before or within 48 hr after transplanting. Do not incorporate. Suppresses nutsedge and nightshade. For use by members of Michigan Veg. Council and Kentucky Veg. Growers Assoc. only. 60 day PHI.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 4.5 pt maximum total per acre. 20 day PHI.
	Postemergence emerged weeds	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	.5	1.5 pt	Use shields to protect crop. Apply in 20-30 gal/acre water. Do not exceed 30 PSI pressure. Do not allow spray to contact crop foliage. Maximum 3 applications per year. 30 day PHI.
	Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Include 1 pt NIS/a.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
POTATO	Emerged quackgrass and other perennials	glyphosate (ROUNDUP) (4 lb/gal)	2	2 qt	Apply to actively growing quackgrass at least 8 inches tall. Wait 3 days before plowing. Heavy stands of rye will reduce quackgrass control. Include 1 pt NIS/a.
	Preemergence annual grasses and broadleaves	EPTC (EPTAM 7E)	4—6	2.3—3.4 qt	Incorporate 3 in. deep immediately after application. Use higher rate for nutsedge and quackgrass suppression. Not effective on muck soil. Follow with delayed preemergence application of linuron or metribuzin.
		s-metolachlor (DUAL MAGNUM 7.6E)	0.95—1.9	1—2 pt	Apply soon after planting. Follow with a delayed preemergence application of linuron or metribuzin. May be applied to emerged potatoes to extend grass control. 40 day PHI.
		pendimethalin (PROWL 3.3E)	0.75	1.8 pt	Apply soon after planting. Do not use on muck soil or soil with less than 1.5% OM. Needs rain within 7 days to activate. Follow with a delayed preemergence application of linuron or metribuzin.
		(PENTAGON 60DG)		1.2 lb	
	Delayed preemergence broadleaves and grasses	linuron	1	2 lb	Follow preemergence treatments listed above. Apply before potatoes emerge, but after weeds have emerged.
		metribuzin (LEXONE 75DF, SENCOR 75DF)	0.5	.67 lb	Follow preemergence treatments listed above. Apply just before potatoes emerge and after weeds have emerged, but are less than 1 inch tall. Do not use on Atlantic or Shepody varieties.
		rimsulfuron (MATRIX 25DF)	0.0238	1.5 oz	Apply after hilling or drag-off before potatoes and weeds emerge. Needs moisture for activation. 60 day PHI.
	Postemergence broadleaves and grasses	metribuzin (LEXONE 75DF, SENCOR 75DF)	0.25	0.33 lb	Apply postemergence over the top of potatoes. Avoid spraying during the 12-15 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 ai/acre/year. Do not use on Atlantic, Shepody, Chip Belle, Bell Chip, or Centennial varieties. 60 day PHI.
		rimsulfuron (MATRIX 25DF)	0.0156	1 oz	Apply over the top of potatoes to small weeds that are actively growing. Include 2 pt NIS/100 gal. When tank-mixing with metribuzin, reduce NIS to 1 pt/100 gal and follow precautions on metribuzin label. 60 day PHI.
	Postemergence grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Use high rate on perennial grasses and large annual grasses. Include 1 qt COC per acre. 30 day PHI.
	Vine kill	diquat (DIQUAT) (2 lb/gal)	0.25	1 pt	Apply to mature potato vines. Make a second application within 5 days if vines are very thick. For Russet Burbank, use 2 pt in first application, 1 pt in second. Include 2 pt NIS/100 gal. 7 day PHI. RUP.
		endothall (DESICATE II) (2 lb/gal)	0.75—1	1.5—2 qt	Apply in 5-40 gal water per acre. Use high rate on lush, dense vines. Add AMS or adjuvant to improve vine kill. Apply at least 10 days before harvest.
		paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.25—0.47	13—24 fl oz	Do not use for potatoes grown for seed or storage. Apply in a minimum of 20 gal/a to mature vines. Use 24 oz for quick vine kill. Use 2 applications of 13 oz for dense vines. Wait 5 days between treatments. 3 day PHI. RUP.

PUMPKIN, SQUASH	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before or after seeding but before crop emergence. Include 1 pt NIS per 100 gal. RUP.
	Preemergence grasses	bensulide (PREFAR 4E)	5—6	5—6 qt	Apply to moderately dry, well-worked soil and incorporate 1-2 inches before seeding.
	Preemergence annuals	clomazone (COMMAND 4E)	0.25—0.375	8—12 fl oz	Pumpkins, all states; summer and winter squash: KY, MI, OH. Incorporate 1 inch or less before planting. Use lower rate on light soils. Good control of velvetleaf. Use with a PRE-grass herbicide. Some squash cultivars are very sensitive to Command. Do not use on bright orange, pink or red <i>C. maxima</i> cultivars. 45 day PHI.
		ethafluralin (CURBIT 3E)	0.75—1.13	2—3 pt	Pumpkins, summer squash, winter squash. Apply to soil surface after seeding, or directed between rows after transplanting. Needs .5 in. rain within 5 days for activation. Heavy rains may cause crop injury.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt/acre/season. 14 day PHI.
	Postemergence emerged weeds	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	.5	1.5 pt	MICHIGAN AND OHIO only. Use shields to protect crop. Apply in 20-30 gal/acre water. Do not exceed 30 PSI pressure. Do not allow spray to contact crop foliage. Maximum 3 applications per year.
	Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Include 1 pt NIS/a.
RADISH	Preemergence	trifluralin	0.5—0.75	1—1.5 pt	Apply and incorporate before seeding. Not effective on muck soil.
	Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting. Include 1 pt NIS/a.
RHUBARB	Preemergence Fall application	pronamide (KERB 50W)	1—2	2—4 lb	MI only. Apply in the fall before November 1 to suppress quackgrass and winter annuals. Do not apply to rhubarb the year of planting. 218 day PHI. RUP.
	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	For use on dormant rhubarb, use higher rate for heavier weed infestation. Do not exceed 2 applications per season. Gives some suppression of quackgrass. Include 1 pt NIS per 100 gal. RUP.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	IL, IN, MI, MN, OH, WI only. Apply to actively growing grasses. Include 1 qt COC per acre. 15 day PHI.
	Perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	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 weed. Include 1 pt NIS/a.
RUTABAGA, TURNIP	Germinating annuals	DCPA (DACTHAL 75W) trifluralin (TREFLAN MTF 4L)	8—10.5 0.5—1	10.5—14 lb 1—2 pt	Apply before crop and weeds emerge. If soil is dry, irrigate lightly after application. WI only. Apply and incorporate before seeding or transplanting. Use lower rate on light soils.
	Emerged perennials and annuals	glyphosate (ROUNDUP) (4 lb/gal)	2—3	2—3 qt	Apply to emerged perennials before planting or after harvest. May be applied with wiper applicator in the crop. Do not allow herbicide to contact crop foliage. Include 1 pt NIS/a.

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
SPINACH	Perennials	glyphosate (ROUNDUP 4L)	2-3	2-3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.
	Germinating annuals, nutsedge	cycloate (RO-NEET 6E)	3	2 qt	OHIO and ILLINOIS only. Mineral soil only. Apply before planting and incorporate 2-3 inches immediately.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19-0.28	1-1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt/acre/season. 15 day PHI.
STRAWBERRY	Germinating annuals	DCPA (DACTHAL 75W)	6-9	8-12 lb	Apply 12 lb Dacthal within 5 days of transplanting as a broadcast spray. On established beds, apply 8-12 lb product in early spring before first bloom or after harvest.
		napropamide (DEVRINOL 50DF)	3-4	6-8 lb	Apply before weeds emerge to newly transplanted or established crop as a broadcast surface spray. Light rain or irrigation after application will improve weed control. May inhibit daughter plant establishment.
	Germinating annuals	terbacil (SINBAR 80W)	0.1-0.3	2-6 oz	Apply to plants established at least 6 months. Apply after renovation before new growth begins, or in late fall. Do not apply more than 8 oz/a/yr. Do not use on soils with less than 2% organic matter. May injure rotational crops.
SWEET POTATO	Emerged annuals	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.5	1.5 pt	Apply as a directed spray, using shields to protect strawberry plants. Do not allow spray to contact strawberry plants. 21 day PHI. RUP.
	Emerged broadleaves	2,4-D amine salts (FORMULA 40) (4 lb/gal)	1	1 qt	Apply after harvest at renovation (after mowing). Do not apply to actively growing plants after August 1 or misshapen fruit may be produced the next season.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19-0.38	1-2 pt	Apply to actively growing grasses. Use high rate on perennial grasses. Include 1 qt COC per acre. 7 day PHI.
SWISS CHARD	Perennial	glyphosate (ROUNDUP 4L)	2-3	2-3 qt	Apply to emerged perennials before planting in the spring or after harvest in the fall. Include 1 pt NIS/a.
	Preemergence annuals	napropamide (DEVRINOL 50DF)	1-2	2-4 lb	Apply immediately after transplanting. If rain does not occur within 24 hr, incorporate it shallowly or irrigate with .5 inch.
	Emerged grasses	DCPA (DACTHAL 75W)	6-10.5	8-14 lb	Apply immediately after transplanting as a broadcast spray, and again 6 weeks later at layby.
SWISS CHARD	Emerged grasses	fluzifop-P (FUSILADE DX 2E)	0.16-0.19	10-12 fl oz	Apply to actively growing grasses. Include 1 qt COC or 1 pt non-ionic surfactant per acre. 55 day PHI.
		sethoxydim (POAST 1.5E)	0.19-0.28	1-1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Max. 5 pt/a/yr. 30 day PHI.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19-0.28	1-1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 3 pt maximum total per acre. 30 day PHI.

TOMATO	Emerged weeds before crop emergence	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before transplanting or before or after seeding but before crop emergence. Include 1 pt NIS per 100 gal. RUP.
Germinating annuals	napropamide (DEVIRINOL 50DF)	1—2	2—4 lb	SEEDED OR TRANSPLANTED. Apply before planting and incorporate 1-2 inches. Use low rate on light, sandy soils. Carryover may affect corn, small grain, alfalfa, lettuce, and sugar beets.	
	trifluralin	0.5—1	1—2 pt	TRANSPLANTED. Apply before transplanting and incorporate 2-3 inches into the soil immediately. Use low rate on light, sandy soils.	
	metribuzin (SENCOR 75DF)	0.25—0.5	.33—.66 lb	TRANSPLANTED. Apply before transplanting and incorporate 2-3 inches into the soil. Usually used in combination with trifluralin to improve preemergence broadleaf control.	
Germinating grasses, nutsedge	pebulate (TILLAM 6E)	4—6	2.7—4 qt	SEEDED. After tomatoes are well established, apply as a directed spray to clean, cultivated soil and incorporate or irrigate in. TRANSPLANTED. Apply and incorporate 2-3 inches before planting. Use low rate on light soils with less than 2% organic matter.	
Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. 4.5 pt maximum total per acre. 20 day PHI.	
	clethodim (SELECT 2E)	0.1—0.25	6—16 fl oz	Apply to actively growing grasses. Include 1% COC in spray mix. Use high rate for perennial grasses and annual bluegrass. Max. 32 oz/a/yr. 20 day PHI.	
Postemergence shielded application emerged weeds	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	.5	1.5 pt	Use shields to protect crop. Apply in 20-30 gal/acre water. Do not exceed 30 PSI pressure. Do not allow spray to contact crop foliage. Maximum 3 applications per year.	
Emerged perennials	glyphosate (ROUNDUP) (4 lb/gal)	2—3	2—3 qt	SEEDED TOMATOES only. Apply to emerged perennials before planting the crop. Wait 3 days before planting. Check label for correct rate for each weed. Include 1 pt nonionic surfactant per acre.	

Crop	Weed Problem	Chemical	Pounds Active Ingredient (AI)/Acre	Amount of Commercial Product/Acre	Remarks and Limitations
WATERMELON	Emerged weeds before planting	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply before seeding or transplanting melons to kill emerged weeds. Include 1 pt NIS per 100 gal. RUP.
	Germinating broadleaves and grasses	ethalfuralin (CURBIT 3E)	0.75—1.13	2—3 pt	DIRECT SEEDED MELONS. Use low rate on light, sandy soil. Apply to soil surface within 2 days of seeding. Do not incorporate. Needs 0.5 inch of rain or irrigation within 5 days to activate it. If no rain occurs, cultivate shallowly. Heavy rainfall after application may cause crop injury. TRANSPANTED MELONS. Apply as a banded spray to soil between rows of plastic mulch. Do not apply over or under hot caps, row covers, or plastic mulch. Do not broadcast over the top of transplants.
		bensulide (PREFAR 4E)	4—6	4—6 qt	Apply and incorporate 0.5-1 inch before seeding or transplanting. Controls many annual grasses. May stunt crop if used under clear plastic. Usually used in tank mix with Alanap.
		naptalam (ALANAP 2L)	3—4	6—8 qt	PREEMERGENCE: Apply and incorporate before seeding or apply soon after seeding. Apply to moist soil or water in. Usually used in tank mix with Prefar. May be used under clear plastic. POSTEMERGENCE: Apply after transplanting, or just before melons vine out. Controls several broadleaves.
		trifluralin (TREFLAN 4E)	0.5—1	1—2 pt	Direct the spray between rows when plants have 3-4 leaves. Cultivate shallowly to incorporate. Avoid contact with crop leaves.
	Emerged grasses	sethoxydim (POAST 1.5E)	0.19—0.28	1—1.5 pt	Apply to actively growing grasses. Include 1 qt COC per acre. Maximum total of 3 pt/acre/season. 14 day PHI.
	Emerged perennials	glyphosate (ROUNDUP 4L)	2—3	2—3 qt	Apply to emerged perennials before planting the crop. Wait 3 days before planting. Include 1 pt NIS/a.
NON-CROP LAND AND SPECIAL WEED PROBLEMS	Bare ground—long term control of annual and perennial weeds	diuron (KARMEX 80DF)	15—20	19—25 lb	For use around buildings, storage areas, fence rows, etc. Apply in spring before weeds emerge.
		hexazinone (VELPAR 90SP)	2—4.5	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 weeds emerge. Will injure or kill perennials. Do not use around shade trees or ornamentals.
	bromacil (HYVAR X 80W)	2.5—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 runoff water to non-target areas. Therefore, do not use in or near turf, ornamentals, or other plants of value.	
	sulfometuron (OUST 75DG)	0.3—0.6	0.4—0.8 lb	Apply preemergence or early postemergence. Gives season-long control of most grasses and broadleaves. Avoid drift.	
		oryzalin (SURFLAN 4L)	4—6	4—6 qt	Apply before weeds emerge. Controls most annual grasses and many broadleaves.

Perennial broadleaves and grasses	glyphosate (ROUNDUP) (4 lb/gal)	2—4	2—4 pt	Apply to actively growing foliage. Check label for most susceptible stage of target weed. Include 1 pt nonionic surfactant per acre.
	sulfosate (TOUCHDOWN) (6 lb/gal)	1.5—4	2—5.3 pt	Apply to actively growing foliage. Include 1 pint NIS plus 3-4 lb ammonium sulfate in 10-30 gal water per acre.
	glufosinate (RELY 1L)	1—1.5	4—6 qt	Apply to actively growing annuals and perennials. Gives quick burndown and long-term control.
Emerged annuals	paraquat (GRAMOXONE EXTRA) (2.5 lb/gal)	0.7—1	2—3 pt	Apply to actively growing foliage. Include 1 pt NIS per 100 gal. Can be used in combination with residual herbicides. RUP.
Emerged grasses	fluzifop-P (FUSILADE DX 2E)	0.25—0.38	1—1.5 pt	Apply to actively growing grasses. Use high rate on perennials and large annual grasses. Include 1 pt NIS or 1 qt COC per acre.
	sethoxydim (POAST 1.5E)	0.3—0.5	1.5—2.5 pt	Apply to actively growing grasses. Use high rate on perennials and large annual grasses. Include 1 qt COC per acre.
Annual broadleaves	2,4-D (several trade names and formulations)	1.5—3		Apply to actively growing foliage. Use amine or low-volatile ester formulations. Check label for amount of product per acre. Avoid drift to non-target areas.
Annual and perennial broadleaves	dicamba (BANVEL) (4 lb/gal)	0.25—2	0.25—2 qt	Controls many annual and perennial herbaceous weeds. Check label for rate for specific weeds. Prevent drift to non-target areas.
Yellow nutsedge	glyphosate (ROUNDUP) (4 lb/gal)	3—4	3—4 qt	Apply in 10-40 gal water per acre. Include 1 pt NIS. Apply to actively growing nutsedge when at least 50% of the plants are in flower. Wait 7 days before tillage. Spot spray escapes 3-4 weeks later.
	bentazon (BASAGRAN) (4 lb/gal)	.75—1	.75—1 qt	Apply in 20-40 gal water per acre and at least 40 PSI. Include 1 qt COC per acre. Apply when plants are 6-8 inches tall. Make a second application 7-10 days later.
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.
	2,4-D+ triclopyr (CROSSBOW 3 lb/gal)	2+1	4 qt	Apply to actively growing herbaceous or woody plants. Controls most broadleaf species.
	triclopyr (GARLON) (4 lb/gal)	4—8	4—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 runoff. Apply in 50 to 300 gal/acre. Avoid contact with non-target plants.
	tebuthiuron (SPIKE 80W)	3—6	4—7.5 lb	Apply to soil around target brush species. Kills slowly but lasts up to 3 years.



PESTICIDE EMERGENCY INFORMATION

For any type of an emergency involving a pesticide, immediately contact the following emergency information centers for assistance.

Current as of December 1998



Human Pesticide Poisoning

MICHIGAN POISON CONTROL SYSTEM

From anywhere in Michigan, call

1 - 8 0 0 - P O I S O N 1
1 - 8 0 0 - 7 6 4 - 7 6 6 1

Special Pesticide Emergencies

Animal Poisoning

Your veterinarian:

Phone No.

or

Animal Health Diagnostic Laboratory (Toxicology) Michigan State University: **(517) 355-0281**

Pesticide Fire

Local fire department:

Phone No.

and

Fire Marshal Division, Michigan State Police: M - F: 8 - 12, 1 - 5 **(517) 322-1924**

Traffic Accident

Local police department or sheriff's department:

Phone No.

and

Operations Division, Michigan State Police: **(517) 336-6605**

Environmental Pollution

Pollution Emergency Alerting System (PEAS), Michigan Department of Environmental Quality:

District MDEQ Office Phone No.

and

For environmental emergencies: ***1-800-292-4706** also ***1-800-405-0101** Michigan Department of Agriculture Spill Response

Pesticide Disposal Information

Michigan Department of Environmental Quality, Waste Management Division. Monday - Friday: 8 a.m.-5 p.m. **(517) 373-2730**

National Pesticide Telecommunications Network

Provides advice on recognizing and managing pesticide poisoning, toxicology, general pesticide information and emergency response assistance. Funded by EPA, based at Oregon State University **7 days a week; excluding holidays 6:30 a.m. - 4:30 p.m. Pacific Time Zone 1-800-858-7378 FAX: 1-541-737-0761**

* Telephone Number Operated 24 Hours