Pesticides, other pest management techniques crucial to American agriculture

American agricultural producers have been able to meet the demands of the public for food through the use of improved agricultural technology. For the past 50 years, agricultural technology has included the use of pesticides and other pest management techniques.

-- Virtually all agricultural commodities produced in Michigan may be threatened by serious pest problems and may be treated with pesticides at some point during their growing season. Disease, nematodes, vertebrate or weed pests. Currently, agricultural producers, as broadly defined by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), are allowed for livestock and crop protection and production.

The use of pesticides has, however, caused environmental and human safety concerns. These include the appearance of pesticide contamination in surface and groundwater in Michigan, destruction of beneficial or non-target organisms, appearance of resistant pest species and pest population resurgence. Strategies for managing pests continue to be developed to reduce undesirable pesticide effects.

Agricultural producers in Michigan are encouraged to adopt practices that utilize pesticides only as needed. Such practices employ the appropriate use of all available information, methods, and technologies to achieve the desired commodity quality and yield while minimizing any adverse effects on non-target organisms, humans, and the environment.

Such practices include, but are not limited to, Integrated Pest Management (IPM) or sustainable agriculture. These practices normally involve environmental and biological monitoring such as scouting, trapping, use of pest prediction models, etc., to help producers determine when pest populations reach the economic action threshold and selection and use of safe and effective control measures. These may include, but are not limited to, biological, chemical, cultural, mechanical, regulatory controls (e.g., inspections, quarantines, fumigation, sanitation etc.) and other pest management methods.

Agricultural producers who comply with pesticide labels and labeling, relevant state and federal laws, Michigan State University pesticide recommendation bulletins, and follow pertinent sections of these Generally Accepted Agricultural and Management Practices for Pesticide Utilization and Pest Control, will meet provisions of Public Act 125 of 1981, as amended, The Right to Farm Act, which is administered by the Michigan Department of Agriculture.

On-farm pesticide storage and containment

If pesticides should be stored in a manner that maintains environmental quality, ensures animal and human safety, and preserves product and container integrity. Legal storage requirements are on pesticide labels.

**Bulk pesticide storage sites**

A site should be selected that minimizes potential for contamination of surface or groundwater by drainage, runoff or leaching. Locate the storage site an adequate distance away from wells, surface water and other sensitive areas, as herein described.

"Surface water" means a body of water that has its top surface exposed to the atmosphere and includes lakes, ponds, or water holes that cover an area greater than 0.25 acres, and streams, rivers, and drainageways that maintain a flow year-round. "Surface water" does not include waterways with intermittent flow (Reference Public Act 171 of 1976, as amended). For purposes of these practices, a bulk storage area is an area where pesticides are stored over 15 days in a single container greater than 55 gallons or 100 lbs.

Existing bulk pesticide storage areas should be located a minimum of 50 feet from any single-family residential water well, 200 feet from a public water supply, and a minimum of 200 feet from surface water. If an existing bulk storage area is located closer than 50 feet from a single-family residential water well, 200 feet of a public water supply or less than 200 feet from surface water, appropriate security measures should be taken to prevent pesticide contamination of surface water or groundwater (Reference E-2355).

New bulk pesticide storage areas should be located a minimum of 150 feet from any single-family residential water well and a minimum of 200 feet from surface water. When planning a new facility, refer to E-2355 for information on design and construction and for the required set-back distance from drinking water supplies. The set-back distance from any Type I or Type II public water supply well is 2,000 feet, if the public water supply does not have a well-head protection program.

This publication made possible by a grant from the Michigan Groundwater Stewardship Program

The second in the Right-To-Farm series deals with pesticide use, equipment and protective clothing each pesticide applicator needs to know before hitting the spring season. Be sure to review the practices covered on the next eight pages with everyone who handles chemicals on your farm to protect their health and the health of the environment. Watch for the next Right-To-Farm issue coming the end of March dealing with nutrient utilization.

Pesticide utilization and pest control practices

**Work and handler safety**

Any person applying or handling pesticides or working in pesticide-treated areas must be knowledgeable in the safe use and handling of pesticides. Everyone must use safety equipment specified on pesticide labels.

The Federal Worker Protection Standard of 1992 was written to protect employees involved in the production of agricultural products on farms, forests, greenhouses and nurseries from occupational exposure to agricultural pesticides.

The standard requires training, notification, and information on the proper use of protective equipment. Handlers include those who apply, load, mix and transport pesticides and who clean and repair pesticide application equipment. Workers include those who may physically come in contact with pesticides in treated areas while performing tasks related to production and harvesting.

Both need to be trained to recognize pesticide poisoning symptoms, avoid exposure and provide emergency assistance. They should be provided personal protective equipment and transportation for medical assistance. Handlers need additional training. Employers are required to provide the training, personal protective equipment, transportation, central notification points, field posting for the duration of the restricted-entry intervals and maintain pesticide application records for three years.

For specific information concerning this law, refer to the EPA prepared book, "The Worker Protection Standard for Agricultural Pesticides, How to Comply. What Employers Need to Know." Enforcement of the standard is in two phases.

Label-specific requirements will be enforced when they appear on pesticide labels. These include:

- Using labeled specified personal protective equipment
- Obeying label specific restrictions on entry to treated areas during the restricted-entry intervals
- Obeying the requirement on labels that provide oral warnings and treated area posting
- The generic requirements were enforceable as of Jan. 1, 1995 and include:
  - Providing decontamination supplies
  - Training workers and handlers
  - Providing certain notification and information
  - Cleaning, inspecting and maintaining personal protective equipment
  - Emergency assistance
Handling pesticides safely

Properly. There are several solutions to this problem. Sites have been at a rich chemical dealerships, the serving participants in areas ranging from two to six counties. The greatest risk occurs when handling pesticide concentrations. Following these practices to reduce risk:

- Pesticide mixing and loading areas should be located in such a manner as to reduce the likelihood of a spill or overflow contaminating a water supply. Acceptable areas may include temporary or permanent sites which are described in bulletin E-2535.

- Review the label before opening the container so the operator is familiar with current mixing and usage directions. If two or more pesticides are to be mixed, they must be compatible and mixed in the proper order. Measure accurately. Keep all measures in the pesticide storage area to avoid their being used for other purposes. Measuring containers or devices should be mixed and the rinsewater put into the spray tank.

- Avoid back-flow when filling a spray tank to prevent water source contamination. The simplest technique is an air gap where the fill hose does not come in contact with the tank wall. Back flow prevention devices may also be used. (Reference E-2549)

- A sprayer should be monitored while it is being operated.

- Mix only the amount you plan to use immediately. Pesticides should be applied as soon as possible to maintain product effectiveness and reduce the potential for accidental discharge.

- Clean up spills immediately. Materials spilled during mixing or loading may be applied to labeled sites or at below labeled rates. Major spills or those exceeding reportable quantities under SARA Title III should be reported to the appropriate agencies. (Reference E-4375) as well as the Michigan Department of Agriculture, Agriculture Pollution Emergency (APE) Hotline, (800) 405-8080.

Transport of pesticides

A person transporting pesticides will do so in such a manner as to avoid discharge into the environment, human exposure, and contamination of animal feed and human food. (Reference Public Act 346, The Commercial Drivers’ License Law of 1988). #

Disposing of empty pesticide containers

Farmers are often faced with the problem of disposing of potentially hazardous pesticide containers. While most ordinary trash cans go to landfills, these sites generally won’t and can’t accept waste classified as hazardous under the U.S. Resource Conservation and Recovery Act (RCRA). Since contaminated pesticide containers and waste chemicals often fall into this category, farmers frequently have difficulty disposing of them properly. There are several solutions to this problem available in most states.

Leftover chemicals

Many farmers, ranchers and custom applicators reuse pesticide containers as they are emptied, dumping the rinse water into the sprayer tank. This saves money and time, and the rinsing action is more efficient if the chemical hasn’t dried in the empty container. Laboratory tests have shown that proper rinsing results in essentially harmless, 99.999 percent pesticide-free containers, regardless of what product they originally contained. Probably the fastest, most efficient and convenient container reuse method is pressure rinsing with metal hose-end attachments which puncture plastic and metal containers, producing a forceful spray of rinse water inside the empty container. By holding the container above the opening to the spray tank while rinsing, the rinse water can be captured as a drain from the empty container spout. Manual rinsing methods, such as triple rinsing, can be as effective as pressure rinsing, although anyone who has tried it will wish that it’s much more time consuming and labor intensive.

Disposing of rinsed containers

When rinsed according to label directions, pesticide containers are classified as ordinary solid waste and may be disposed of or recycled. Be aware, however, that some waste disposal operators will still turn away rinsed containers, even if they have adequate landfill capacity. States also have jurisdiction over burning and burying containers on private property. Contact your ag chemical dealer for state disposal regulations, and rules on burning or burying containers.

Recycling empty containers

Collection and recycling programs are available in a number of states. If you have the opportunity to participate in a recycling program, be sure to follow all disposal regulations and rules on burning or burying containers.

Disposal of unused pesticides

The Michigan Department of Agriculture has sponsored regional pesticide recycling collections using local planning committees to establish collection sites serving participants in areas ranging from two to six counties in size. Participation can be arranged by contacting the county MSU Extension office, MDA, or the Soil Conservation District. Since many of the collection sites have been at agrichemical dealerships, the agricultural dealers may also be able to provide current information to participants in contact with the program.

The average participant brings in 200-300 pounds of unusable pesticide, which is managed at no cost. A small fee may be required if the number of participants in the region is high or for those who have very large amounts.

To assure there are funds for disposal, the application form asks the participant to identify the amount and type of pesticide. Except for the very large amounts, no paperwork is required of the participant.

The Michigan Department of Agriculture or the contractor becomes the generator of record and is responsible for the disposal once accepted at the collection site.

Disposal of pesticide containers

When the disposal of containers in a way that minimizes impact on the environment and is consistent with the label specifications. It is desirable to use reusable, returnable, or recyclable containers when available.

Pesticide disposal practices

Excess spray mixtures and rinsates

Use excess mixtures or rinsates on labeled application sites at or below labeled rates as listed on the label. Excess pesticide mixtures include, but are not limited to, leftover solution from a spraying job interrupted by weather or equipment breakdown.

All rinsates, including pesticide container rinsates should be put in the sprayer as part of the mixing solutions. Sprayer rinse-out solution should be sprayed on labeled application sites at or below labeled rates.

Disposal of unused pesticides

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Disposal of pesticide containers

When the disposal of containers in a way that minimizes impact on the environment and is consistent with the label specifications. It is desirable to use reusable, returnable, or recyclable containers when available.

Pesticide containers should be emptied completely, rinsed when appropriate, and in general rendered a non-hazardous waste.

- Triple rinse or use other recommended practices, such as pressure rinsing use of clean all glass, metal, or plastic containers to render them non-hazardous waste. (Reference AM-95)

- After rinsing, puncture metal and plastic containers. They can then be recorded or buried in a sanitary landfill approved under PA 641, of 1978.

- Michigan has had an agriculture pesticide container recycling program in operation since 1992. This program allows for the grinding and recycling of clean plastic containers. For more information on this program, contact Michigan Department of Agriculture at (517) 241-0268 or Michigan Ag-Business Association at (517) 409- 8986.

- Disposal of rinsed glass containers in a sanitary landfill approved under PA 641, of 1978.

- Open burning of pesticide containers is prohibited by state statute, PA 349 of 1985 amended. #

Source: Agriculture for a Clean Environment, an organization sponsored by the American Crop Protection Association and the Agricultural Retailers Association.
Protection of the environment

Agriculture involves management of biological systems to produce food, feed, for fiber. Pesticides and other pest management practices can have a specific effect in a biological system.

For agriculture to be sustained at biologically and economically sound production levels, growers should recognize their responsibility to the health of the soil and the environment. Growers should be aware of environmental sensitivity in pest control system and adjust management practices to ensure future productivity and environmental integrity. For example, growers should limit use of highly toxic moderatelyleachable pesticides in areas with coarse-textured soils or high water tables.

Pesticides and other pest management practices use of highly or moderately leachable pesticides in soybeans, corn (herbicide vs. fungicide, etc.) and other crops. The standard, MSU pesticide recommendations, their production system and adjust management practices specifically developed for the protection of groundwater.

- Utilize safety measures including backflow safety devices when applying pesticides through irrigation systems. (Reference B-2059 and B-2439)

Post key information

Pesticide storage area safety

Storage of crop protection chemicals poses little threat when safety is considered and your storage area is properly maintained. The following tips may help you protect your storage area hazards to a minimum.

Location of storage areas

The storage location should be secure, dry, well ventilated, with fire retardant construction and an unbroken concrete floor to prevent groundwater contamination. Use of soil as fill is not recommended. The storage should be located down slope and at least 100 feet from wells and drained from other water sources such as streams and ponds. It also should be located at least 50 feet from open fields to prevent flooding.

Post key information

Product labels and Material Safety Data Sheets (MSDS) for pesticides stored should be posted in your storage area, along with any safety instruction. Familiarize yourself and your employees with any hazards associated with handling specific products. Post emergency telephone numbers near the telephone closest to your storage area.

Calibrating and maintaining spray equipment

Faced with production deadlines, a non-performed task can often mean a back seat when it’s time to calibrate spray equipment. Complex formulas and time consuming calculations can be discouraging. But calculation errors can add excess chemical costs, reduce yields and increase potential for water contamination.

To avoid these problems, calibrate your spray equipment at least once a year with these 10 easy steps. Use a plastic container marked in ounces (a boll or a measuring cup works well) collect the water that was sprayed from one nozzle during the same lapse of time you took to drive the test course. Average your collection with several tries. Be sure to the test course at a normal spraying speed. Be sure to operate all equipment, spraying clean water over the next course. The important step is to record the seconds it takes to drive the measured distance. You’ll use that number later. Be sure controls, resistant varieties, cover crops, crop vacuumers, crop flammers, mulching, composting, crop rotation, phenomena for mixing disruption and crop injury, etc. All such techniques should be used according to dealer and for agricultural practices and must be used according to federal and state agencies regulations and/or regulations.

Agriculture pollution emergencies

The Michigan Department of Agriculture has a toll-free, 24-hour hotline available for reporting agricultural pesticide, fertilizer, and manure spills. The MDA Agriculture Spill Emergency (APE) Hotline, (800) 405-0101, is designed to improve response time and provide appropriate technical assistance, including the environment risk associated with an agricultural chemical spill.

Users of agricultural pesticides, fertilizer, and manure products should report all uncontrolled spills or releases to the MDA APE Hotline. MDA has the responsibility to initiate response activities immediately stop or prevent further releases at agricultural spill sites and will do so through possible interaction and assistance from the Michigan Department of Environmental Quality (MDEQ). The main goal of the MDA Spill Response Program is to prevent spills, spills, spill cleanup efforts, and prevent unnecessary hazards. Be sure to carry an MSDS for each product when transporting pesticides. These recommendations should not be used as the sole criteria for evaluating the adequacy of a pesticide safety program. For further information on the application of water, contact your local dealer or manufacturer representative.

Calibrating

1. Fill your tractor/sprayer tank with water.
2. Check the distance in inches between the nozzles on your spray boom.
3. Choose the course length (in feet) from the chart at left. At desired speed, round the row spacing of the field you plan to spray. Measure the course distance in the field and flag it for easy visibility.
4. Drive the test course at your normal spraying speed. Be sure to operate all equipment, spraying clean water over the next course. The important step is to record the seconds it takes to drive the measured distance. You’ll use that number later.

Recipe

- Fill your tractor/sprayer tank with water.
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Pesticide recordkeeping

Firm operators must maintain accurate records of all agricultural crop applications of pesticides for at least three years. Federal pesticide recordkeeping regulations, the federal worker protection standards, and the Michigan Right-to-Farm Practice all have requirements related to pesticide recordkeeping. The following table is intended to help clarify what data are required for each of these pieces of legislation. The federal recordkeeping regulations and worker protection standards are found in 40CFR170. The Michigan Right-to-Farm Practice is a set of voluntary guidelines.

Federal Recordkeeping Regulations (Redkp)

The data required by these regulations must be kept by private pesticide applicators for each restricted use pesticide application.

Worker Protection Standards (WPS)
The information based in the table is that which must be posted for at least 30 days after the end of the restricted-entry interval (REI) or, if there is no REI, for at least 30 days after the end of the application.

Recordkeeping requirements for private pesticide applicators

Federal Recordkeeping Regulations (Redkp), Worker Protection Standards (WPS), Michigan Right-to-Farm (RTF)

Data to Record

Redkp

WPS

RTF

Month/day/year

X

X

X

Time of Application

X

X

X

Pesticide brand or product name

X

X

X

Pesticide formulation

X

X

X

EPA registration number

X

X

X

Active ingredient(s)

X

X

X

Restriction entry interval (REI)

X

X

X

Rate per acre or unit

X

X

X

Crop, commodity, stored product,

X

X

X

or site that received the application

Total amount of pesticide applied

X

X

X

Size of area treated

X

X

X

Applicator's name

X

X

X

Applicator's certification number

X

X

X

Location of the application

X

X

X

Method of application

X

X

X

Target pest

X

X

X


Sample pesticide label

The pesticide label is the key to safe and effective use of the pesticide. All consumers of pesticide should read and follow the pesticide label instructions. The pesticide label is the authoritative source of information from which all consumer decisions regarding pesticide use should be made. The consumer must contact their county Extension Office to obtain pesticide labels, or contact the Michigan Department of Agriculture and Rural Development (MDARD) Consumer Protection Program.

A Pesticide label must contain the following information:

- Name of the pesticide
- Full listing of all active ingredients
- Directions for use
- Precautionary statements
- Storage and disposal
- Personal protective equipment
- Application instructions
- Warnings
- Registered states
- Expiration date

Obtaining pesticide applicator certification

The National Right-to-Farm Guide is sponsored by the Michigan Agribusiness Association (MAA) and the Michigan Farm Bureau. The Guide is a comprehensive manual that provides practical information on the right-to-farm issues that may be encountered on farms and in rural areas.

Michigan Right-to-Farm (RTF)

A portion of the Right-to-Farm document addresses pesticide recordkeeping. By following these voluntary guidelines, producers can reduce their liability.

Commercial applications have 30 days to send a copy of records required by USDA to clients. If a medical emergency occurs before 30 days, commercial applicators must provide the necessary information immediately upon request.

For federally restricted use pesticides (RUP) records must incorporate all information required by Title 40 of the Federal Food, Agriculture, Conservation and Trade Act Subtitle H, Section 4101, Pesticide Record Keeping.
Preventing pesticide spray drift during ground application

Whenever pesticides are applied by ground application or by air, the potential exists for off-target movement or drift. This can create risk for nearby people and wildlife, damage non-target crops, and potentially pollute surface and groundwater resources.

An applicator can minimize spray drift and the risks associated with it, however, by using better equipment, being mindful of weather conditions and practicing sound judgment. Farmers should be aware of the principal factors that can affect drift, including droplet size and application pattern, equipment adjustments and weather conditions during application. Another key factor is sound judgment. Simply planning for the possibility of off-target movement of pesticides is a key step in reducing spray drift.

Doing so will not only improve your application efficiency and bottom line, but will eliminate concerns about downwind safety and the environment when making ground applications of pesticides.

Factors affecting drift

Several factors should be considered when planning a ground application of pesticides to avoid harmful spray drift.

Droplet size

This is probably the most important factor affecting the potential for spray drift, as smaller droplets remain suspended in the air much longer and can drift longer distances than larger droplets. Droplet size can be regulated by selecting the proper nozzle type and size, adjusting the spray pressure and increasing the viscosity of the spray mix. It is important to use nozzles that produce narrower spray fan angles. This keeps the boom as close to the spray target as possible, while maintaining proper spray pattern. Another tip is to use minimal spray pressure, being sure to check pressure gauges for accuracy. You may also wish to install shields or shades on your booms.

Weather conditions

Wind speed and direction, relative humidity, temperature and atmospheric stability are critical weather factors that have an impact on spray drift. It’s important to avoid spraying on extremely hot and dry days, when conditions are favorable for an atmospheric inversion. Winds speeds of less than four miles per hour or more than 12 miles per hour also produce risky conditions. The impact of weather can be minimized by increasing the size of droplets, adjusting application to take advantage of wind direction or speed, and by using adjuvants.

Equipment adjustment

Routine sprayer calibration and replacement of worn spray nozzles should be high on your maintenance list. Other routine equipment adjustments should be identified to increase application accuracy and help reduce spray drift.

Environmental planning

Being sensitive to the unique environment of your farm is a key component of the planning needed prior to and during pesticide application. Consider leaving an unsprayed strip or buffer zone around water supplies, sinkholes, abandoned wells, wetlands, downwind neighbors or sensitive crops. If you must spray these areas, be sure to do so when conditions are favorable.

Planning checklist

- Use nozzles that produce narrower spray fan angles.
- Keep the boom as close to the spray target as possible while maintaining proper spray pattern.
- Use minimal spray pressure and check pressure gauges for accuracy.
- Install shields or shades on booms.
- Avoid spraying on extremely hot and dry days.
- Do not spray when conditions are favorable for an atmospheric inversion.
- Leave an unsprayed strip of 30 to 100 feet near water supplies, abandoned wells, wetland areas, downwind neighbors or sensitive crops.
- If you must spray these areas, do so when the wind is favorable.

Application equipment, methods and formulations

Pesticide application methods

Generally accepted methods of pesticide application include, but are not limited to, the following equipment, methods and formulations.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Methods</th>
<th>Formulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>airassened applicator</td>
<td>aerial</td>
<td>aerosol, suspened, dry flowable</td>
</tr>
<tr>
<td>backpack sprayer</td>
<td>backpacking</td>
<td>controlled droplet, application (cda) formulation</td>
</tr>
<tr>
<td>controlled droplet applicator</td>
<td>d &amp; d</td>
<td>dispersable granule</td>
</tr>
<tr>
<td>fabric mesh and other products</td>
<td>fabric mesh</td>
<td>dusting, dry flowable</td>
</tr>
<tr>
<td>hand sprayer</td>
<td>hand sprayer</td>
<td>early preplant (epp) dry soluble, emulifiable concentrate</td>
</tr>
<tr>
<td>granular applicator</td>
<td>granular</td>
<td>granular surface application encapsulated</td>
</tr>
<tr>
<td>granule</td>
<td>granule</td>
<td>hopperspray treatment</td>
</tr>
<tr>
<td>hand sprayer</td>
<td>hand sprayer</td>
<td>impregnated on fertilizer, flowable</td>
</tr>
<tr>
<td>hopperbox application</td>
<td>hopperbox</td>
<td>injection, liquid</td>
</tr>
<tr>
<td>incorporation into asphalt</td>
<td>incorporation</td>
<td>liquid</td>
</tr>
<tr>
<td>irrigation equipment</td>
<td>irrigation equipment</td>
<td>liquid or solution</td>
</tr>
<tr>
<td>low-volume applicator</td>
<td>low-volume applicator</td>
<td>post-directed ready to use</td>
</tr>
<tr>
<td>roll</td>
<td>roll</td>
<td>post-emergence (post) soluble granule</td>
</tr>
<tr>
<td>speed treated</td>
<td>speed treated</td>
<td>post-transplant soluble powder</td>
</tr>
<tr>
<td>speed treated</td>
<td>speed treated</td>
<td>ropecip</td>
</tr>
<tr>
<td>spray</td>
<td>spray</td>
<td>seed treatment, ultra low volume (ulv)</td>
</tr>
</tbody>
</table>

The application equipment used and other factors determine the appropriate pesticide formulation.

Proper cleanup of pesticide spills

Spills when handling, transporting or using pesticides are a concern for every producer. But by knowing what to do if a spill occurs, whether it's on your property or on the road, you can help minimize risk and protect ground and surface water contamination. Here are some tips for proper cleanup of spills.

- Call your retailer. Get advice quickly from your ag chemical retailer on cleanup of specific chemicals. They can also provide you with special safety advice and other information.
- Call your retailer. Get advice quickly from your ag chemical retailer on cleanup of specific chemicals. They can also provide you with special safety advice and other information.
- Use absorbent materials. On pavement or concrete, use absorbent materials to capture the spilled liquids. They can then be shoveled or swept into disposal containers. Nonchlorinated pet litter is an excellent, inexpensive absorbent material to keep on hand for such purposes.
- Properly dispose of the drenched materials. The size and content of the spill and spill regulations will determine how you dispose of the drenched soil or absorbent materials. Contact state or local officials or your retailer for legally acceptable disposal options.
- Report the spill. If required, report the spill before it threatens public health or the environment. If the spill is large or enter a waterway, you will need to call the local EPA office, local emergency planning office, or the state health department. The reporting criteria varies with the chemical spilled, however, so ask your dealer to check the Material Safety Data Sheet or call the manufacturer for further details. Important telephone numbers include: Chemstar: Emergency Hotline: 800-424-9500, EPA Pesticide Management & Disposal: 703-205-3785, EPA Hazardous Waste Hotline: 800-424-9546, EPA Safe Drinking Water Hotline: 800-424-9791.

Novelized per liter is an excellent, inexpensive absorbent material to keep on hand for spill cleanup. It should be properly disposed of the contaminated material when finished.

Source: Agriculture for a Clean Environment, an organization sponsored by the American Crop Protection Association and the Agricultural Retailers Association.
Using pesticides properly, safely is key

In the rush of the growing season, it’s easy to overlook important safety precautions when using pesticides. Reap the benefits of pesticides that can quickly disappear if accidents occur due to improper use or environmental contamination results. To avoid such mishaps, “take time for safety” before using pesticides—no matter how familiar you are with a specific product, pesticide, or pesticide application. Here’s what you should do:

Read label instructions.

No matter how familiar you are with a specific product, paper label to the label for important application guidelines, chemical compatibilities and precautions for safety and environmental protection. The label information is advertising’s arch enemy. It provides exact application procedures, chemical compatibilities, and precautions against hazards to people, wildlife, and the environment, proper storage instructions, and emergency response information—and the product manufacturer’s name and address.

Wear personal protective equipment.

When handling or applying pesticides, appropriate personal safety equipment is essential. Start out by routinely wearing a wide-brim hat, long-sleeve shirt, long pants, and chemical-resistant gloves. You should also wear sturdy work shoes or rubber boots, not sneakers or sandals when handling pesticides. Depending on the product you are using, it may be necessary for you to wear goggles, a face shield or respirator. Be sure to keep a supply of clean water handy in your truck and spray rig, and two- or three-ply chemically resistant gloves and facial protection before eating or smoking. When opening containers, pour or apply chemicals—especially those carrying WARNING, DANGER or DANGER/POISON signal words on the label. Keep an approved emergency eyewash bottle close at hand.

Keep pesticides and equipment handy.

Respirators are often required by law when working with some products. A dust mask is no substitute for a pesticide respirator. Make sure the respirator you use is approved for pesticide use. Train your employees to use respirators properly, keep them clean and change filters as needed. Keep a supply of replacement parts handy.

Other protection.

Wide brim hats protect the head and neck while applying chemicals overhead, although hat and scarf should be thoroughly washed after using chemicals. Rubber aprons may be required by the label of some pesticides. They provide protection from splashes, container leaks, broken hoses or other unexpected exposures. Finally, remember that water is cheaper. Invest in a fresh water supply at all times for emergencies and routine wash ups.

Cleaning up after pesticide use

At the end of a long day of field or yardwork, your first thought is probably eating a hot meal or taking your face out of the sun. But this is not the time to relax. There are work habits to consider. Whether you are handling pesticides or not, proper work habits are essential. Wear protective equipment when handling pesticides. This means:

- Always pressure-rinse or triple-rinse pesticide equipment after using the liquid pesticide. Prevent tank overflow by never leaving a sprayer unattended during filling. Use a 100-foot hose to move chemical mixing and loading operations as far away from yourself as possible. Be sure to wash all chemical mixing and loading equipment. Never leave a sprayer unattended while filling, an especially important precaution. When filling sprayers, avoid back splashing by keeping the spray nozzle 3 ft. or more away from the tank at all times. If you put on your protective clothing and then go down into the pesticide liquid in the tank, you run the real risk that the hose will suck you down into the pesticide instead of in the wash. Be sure to wash all mix-out water used during pesticide mixing.

Calibrate your sprayer.

After you’ve read the label and chosen the right application rate, it’s important to make sure your sprayer is delivering the right amount of pesticide per acre. Calibrate your sprayer before the season begins and throughout the season. Be sure to check nozzles by measuring the flow of water from each nozzle on the boom to ensure uniform distribution. If the flow rate of any tip is 10 percent greater or less than that of the others, replace it. If two or more are faulty, replace all tips on the entire boom. The total expense involved is small compared to the cost of wasted product or environmental harm. Whatever type of spray tip you choose, be sure to use all the same type on your boom.

Wash pesticide-contaminated clothing.

When handling or applying pesticides, appropriate personal safety equipment is essential. Start out by routinely wearing a wide-brim hat, long-sleeved shirt, long pants and chemical-resistant gloves. You should also wear sturdy work shoes or rubber boots, not sneakers or sandals when handling pesticides. Depending on the product you are using, it may be necessary for you to wear goggles, a face shield or respirator. Be sure to keep a supply of clean water handy in your truck and spray rig, and two- or three-ply chemically resistant gloves and facial protection before eating or smoking. When opening containers, pour or apply chemicals—especially those carrying WARNING, DANGER or DANGER/POISON signal words on the label. Keep an approved emergency eyewash bottle close at hand.

Clothing counts.

A long-sleeved shirt, long pants or coveralls, and high top shoes or boots are also important safety precautions for comfortable and effective worker protection, regardless of style. Sandals or sneakers are totally unsafe, and even leather shoes pose a risk, for they can absorb chemicals. Rubber boots or rubber shoe covers work best.

Washing pesticide-contaminated clothing.

Here’s what to do with those coveralls, socks and other clothing if you’ve been applying pesticides:

- Work wash clothing promptly. Even if they look clean, always wash clothing promptly after applying pesticides. The longer soaked clothing is stored, the harder it is to remove chemical contaminants.

- Handle contaminated clothing properly. Wear rubber gloves when handling contaminated clothing. If liquid chemicals have spilled on any clothing other than rubber gloves or boots, throw them away—they can’t be completely cleaned. Goggles or safety glasses should be removed from cuffs and pockets outdoors.

- Pre-treat or presoak contaminated clothing. In a washing machine filled with hot water and heavy-duty detergent, pre-treat or presoak a few items of clothing at a time. Then spin out and drain until the contaminated clothing is removed from the wash cycle. Pre-treating followed by regular wash is the most effective method of removing contamination from clothing.

- Careful washing and rinsing is essential. After pre-washing, fill the washing machine a second time with hot water and heavy-duty liquid detergent, select a normal wash cycle if it is available.

- Clean the empty washing machine. When you are finished, be sure to run a complete hot water, heavy-duty detergent cycle to thoroughly remove any remaining chemical residues.

- Line dry the clothing. Unless a dedicated work clothes dryer is available, lay your clothes out to dry, avoid possible contamination of the dryer family.

- Add starch as an added protective measure. Recent research by Cornell University textile scientists shows that starch provides a finish that traps pesticides and helps prevent their transfer to skin. The starch-bound chemicals will rinse away when the clothing is washed.

- Don’t forget to wash safety equipment. Safety equipment is only as good as it is clean, so don’t forget to wash your gloves, aprons and boots daily and check for leaks and proper fit. Fill your gloves with clean water and squeeze. Throw away any gloves that leak.

- Source: Agriculture for a Clean Environment, organization sponsored by the American Crop Protection Association and the Agricultural Retailers Association.

Using pesticides properly, safely is key

It’s easier to overlook important safety precautions when using pesticides. Reap the benefits of pesticides that can quickly disappear if accidents occur due to improper use or environmental contamination results. To avoid such mishaps, “take time for safety” before using pesticides—no matter how familiar you are with a specific product, pesticide, or pesticide application. Here’s what you should do:

Read label instructions.

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- Source: Agriculture for a Clean Environment, organization sponsored by the American Crop Protection Association and the Agricultural Retailers Association.
Pesticide use recommendations and technical assistance

Michigan State University Extension provides education and recommendations on correct and effective use of pesticides on most agricultural commodities grown in Michigan (see list at right). Growers meet pesticide rate standards for Generally Accepted Agricultural and Management Practices if they apply pesticides at or less than legal labeled rates. Pesticides for uses not included in MSU recommendations but in accordance with their respective registration labels will also meet the application rate requirements of these Generally Accepted Agricultural and Management Practices.

The Natural Resources Conservation Service (NRCS) rule is to provide technical assistance to agricultural producers. Their Field Office Technical Guide (FOTG) provides general practices that establish minimal acceptable elements of conservation plans designed to maintain soil productivity and prevent water pollution.

The Michigan Certified Crop Adviser (CCA) is a nationally recognized, voluntary certification program that is designed to promote knowledge and understanding of the efforts of the public sector and the agriculture industry to ensure high standards for crop advisories. It is intended that CCAs who have earned their pesticide, crop, or environmental recommendations to producers, including dealers, distributors, applicators, consultants, manufacturers, allied industries, and state and federal agency personnel. The CCA program is administered by state boards in association with the American Society of Agronomy, which handles insurance programs for specialists in agriculture, crop consulting, weed science and other agricultural disciplines.

Agency recommendations

MSU pesticide use and pest control recommendations are contained in, but not limited to, these publications and computer programs:

E-154 Fruit spraying calendar for commercial cherry
E-312 Control of insects, diseases, and nematodes on commercial vegetables
E-434 Control of insects on vegetables
E-1582 Chemical control of insects and nematodes in field and forest crops
E-2022 1987 Disease Control Guide for Broadleaf Trees, Strawberries, Ground Covers, and Vines
E-2088 Insect and mite management on landscape plants
E-2178 Insect, mite, and disease management on commercial turfgrass
E-2572 Control and Management of Insect Pests on Christmas Trees
NCR-251 Effective Herbicide Use on Christmas Tree Plantations
NCR-300 North Central Weed Control Guide for Commercial Crops
NCR-491 Control of Diseases on Commercial Outdoor Floor Plants
NCR-527 Control of Diseases on Commercial Greenhouse Crops
NCR-558 Beetle Control for the Greenhouse Industry
CP-028 CORNHUB

Local information about the classification of public waters supplies; to protect the public health; to provide for the prevention and control of diseases and disabilities; and to provide for the definition of "pesticide" and its proper use.

For more information, contact the Michigan Department of Agriculture at (800) 292-4706.

Pesticide use

Pesticides are chemicals that are used to control pests such as insects, rodents, and weeds. They are used in agriculture to protect crops and livestock from damage caused by pests. Pesticides can also be used in the home and garden to control pests that can cause damage to property or harm to humans.

MSU Extension provides recommendations for using pesticides safely and effectively. These recommendations are based on the latest research and best practices. They are available in publications, fact sheets, and online resources.

Community Right-to-Know Law

The Community Right-to-Know Law requires employers to develop and implement worker protection plans for pesticide handlers. These plans must include information on the hazards of pesticides, the proper use of personal protective equipment, and the correct disposal of pesticides.

The Michigan Department of Environmental Quality has developed a database to track pesticide use in the state. This database can be accessed at the Michigan Department of Environmental Quality website (www.dnr.state.mi.us). The database contains information on pesticide use by commodity, county, and pesticide application.

The National Pesticide Information Center (NPIC) is a federal program that provides information on pesticides to the public. The NPIC is located at the University of California, Berkeley, and can be contacted at (888) 776-8977. The NPIC provides information on the proper use of pesticides, the potential hazards of pesticides, and the proper disposal of pesticides.
Pesticide applicator survey — What the survey says ...

The majority of the respondents were satisfied with the information they received from department staff which accompanied the exam. The results of the exam were returned in a reasonable length of time. Several respondents indicated the results of the exam reflected the questions which were answered incorrectly. In addition it was suggested there be an exam for fruit growers and field crop applicators rather than a general exam. Several suggestions made to improve the exam:

• Provide a question on how to mix products into the sprayer after you have determined the rate of applications.
• Offer exam sessions at the Secretary of State office.
• Offer test at different times of the day, morning, noon and evening at the same location.
• Develop an exam that, once graded by the examiner, the farmer can have the test results.

Over two-thirds of the respondents have attended college or vocational school and are 31 years of age or younger. A few respondents believe recertification is not necessary but rather attend a few chemical meetings. The information presented in the meeting will assist the farmer on technology change faster than taking an exam every three years. Also the question was raised, why don’t homeowners take an exam for lawn and garden care?

The overwhelming majority of the respondents are very satisfied with Michigan Department of Agriculture pesticide applicator certification program. Examination seminars where exam recertification credits are obtained are beneficial. These sessions need to stress protecting the environment and how to properly apply pesticides. The information at these meetings can be directly applied to the operation, while some of the information in the manual or on the exam may not be useful in applying and handling pesticides on the farm. It was suggested that these sessions be offered at least twice a year. Attending seminars should result in recertification every five years rather than the current program of every three years also was suggested. Finally, the respondents agreed that the certifier does not replace proper management. Each individual applicator still has to be responsible and follow the labeled directions.

Preparing for the applicator certification exam, the majority of the respondents attended a training program. The quality of learning material and length of the program was very beneficial. Several respondents expressed the need to have additional training sessions or review sessions. In addition, about 80 percent of the farmers spent time on their own studying the pesticide applicator core manual. While the majority packed up the manual at their local Extension office, over 25 percent ordered the manual from MSU Extension Bulletin office. Paragraphs which used the manual found it easy to understand.

The vast majority of respondents (95 percent) found it easy to obtain a certification application form. In addition 95 percent of the respondents found the certification exam right or easy based on the knowledge of material covered in the exam. Over 93 percent of the respondents found the context of the exam applicable to their pesticide application activities. The questions were clear and understandable and related to current pesticide application. The majority of the respondents felt the overall length of the exam to be about right.

How do you feel about the requirements for people who apply restricted use pesticides?

<table>
<thead>
<tr>
<th>Quality</th>
<th>Content</th>
<th>Preparation</th>
<th>Usefulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>64%</td>
<td>4.5%</td>
<td>7.1%</td>
<td>62%</td>
</tr>
<tr>
<td>25.3%</td>
<td>45.4%</td>
<td>87.1%</td>
<td>61.4%</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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To obtain pesticide applicator certification, candidates must pass an exam administered by the Michigan Department of Agriculture. The Pesticide Applicator Core Training Manual serves as a study guide. Following is an excerpt from the manual.

Compatibility of pesticides

Two or more pesticides may be combined and applied at the same time. Such mixtures can save time, labor and fuel. Manufacturers sometimes combine pesticides for sale as a premix, but pesticide handlers also sometimes combine pesticides at the time of application.

Unless federal law, combining pesticides is illegal unless the pesticide label of any of the pesticides involved instructs you not to combine them. However, not all pesticides work well when mixed together. They must be compatible — that is, mixing them together must not reduce their safety or effectiveness in any way. The more pesticides you mix together, the greater the chance of undesirable effects.

Several possible types of incompatibility should be considered before an applicator attempts to mix products — physical, chemical, phototoxicity, placement and timing.

Some pesticide mixtures that are physically incompatible make the mixture difficult or impossible to apply and may clog equipment, pumps and tanks. These reactions sometimes cause the pesticide to form lumps or gels, to become solids that fall to the bottom of the mix tank or to separate into layers that cannot be remixed.

Sometimes the combined pesticides create a chemical reaction that cannot be seen by looking at the mixture. However, the chemical change can result:

• Loss of effectiveness against the target pests.
• Increased toxicity to the pesticide handler.
• Injury to the treated surface.

Some pesticide labeling lists pesticides (or other chemicals or fertilizers) known to be compatible with that formulation. If you cannot find information on the compatibility of the two pesticides (or the pesticide and other chemicals) that you wish to mix, mix a small amount of the mixture before mixing large volumes. Consult the manufacturer for information. This process is described in the next section.

Preparing to use pesticide application when the pest is at a vulnerable stage of development. When using two or more chemicals to manage different pests, it is of utmost importance that these products be applied at the correct time in the life cycle of all pests involved to be effective.

Phototoxic incompatibility occurs when a product mixture causes injury to plants damaged with the mixture. This can happen even though each of the pesticides in the mixture, when applied separately, does not cause injury.

Lastly, when mixing two or more pesticides, be sure that they are both required to be placed at the site or on the target pests in the same manner — e.g., avoid combining a foliar pesticide with a pesti- cide that must reach the root zone of a plant.

Table 3.1 — Amounts of pesticide(s) and diluent to use in compatibility test

<table>
<thead>
<tr>
<th>Amount of diluent to add to a quart jar</th>
<th>Amount of diluent to add to a quart jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 gallon</td>
<td>15 gallon</td>
</tr>
<tr>
<td>0.4 pint (6.4 oz)</td>
<td>0.6 pint (9.6 oz)</td>
</tr>
<tr>
<td>20 gallon</td>
<td>25 gallon</td>
</tr>
<tr>
<td>0.8 pint (12.8 oz)</td>
<td>1.0 pint</td>
</tr>
<tr>
<td>30 gallon</td>
<td>40 gallon</td>
</tr>
<tr>
<td>1.2 pints</td>
<td>1.6 pints</td>
</tr>
</tbody>
</table>

*Amount of pesticide(s) to be added to quart jar

Table 3.2 — Amounts of diluent to use in compatibility test

<table>
<thead>
<tr>
<th>Amount of diluent to add to a quart jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 teaspoon for each quart of C. E. recommended per acre</td>
</tr>
<tr>
<td>1/2 teaspoon for each pound of W. recommended per acre</td>
</tr>
</tbody>
</table>

Remember, never assume that pesticides can be mixed together or mixed with a fertilizer unless the combination is specifically indicated on a product label. If recommendations for use are not given on the label, the products in the mix must be applied at a rate not to exceed the label directions for any one component product applied alone for the same purpose, and the mix can be applied only if not prohibited by any of the component product labels.

Compatibility testing — First, put on personal protective equipment required by the labeling of any of the pesticides to be combined. Get a large, clean, clear glass container, such as a quart jar. Use the same water (or other dilutent) that you will use when making up the larger mixture for application. Add to the container and each of the products in the same proportions as you will mix them for your treatment. If you are working with large areas, Table 3.1 will help you mix the appropriate amounts of diluent and pesticide for the compatibility test. Unless the pesticide labeling states otherwise, add pesticides to the diluent (usually water) using the "W-A-A-B" plan:

1. Add some of the diluent first.
2. Add Wettable powder or water-based diluent next.
3. Add the liquid products, such as solutions, surfactants, and flowables next.
4. Add Emulsifiable concentrates last.

Shake the jar vigorously. The sides of the jar should be heated as the mixture is going off heat. If so, the mixture may be undergoing a chemical reaction and the pesticides should not be combined. Let the mixture stand for 15 minutes and feel again for unusual heat.

If scum forms on the surface, if the mixture changes in any way, add the mixture to the boom (except for wettable powders), the mixture probably is not compatible. Some commercially available adjuvants, known as compatibility agents, may be added to overcome physical incompatibilities between certain pesticides. These should be added into the quart jar at the beginning of the compatibility test to determine their effectiveness. Finally, if no signs of incompatibility appear, test the mixture on a small area of the surface where it is not to be applied.