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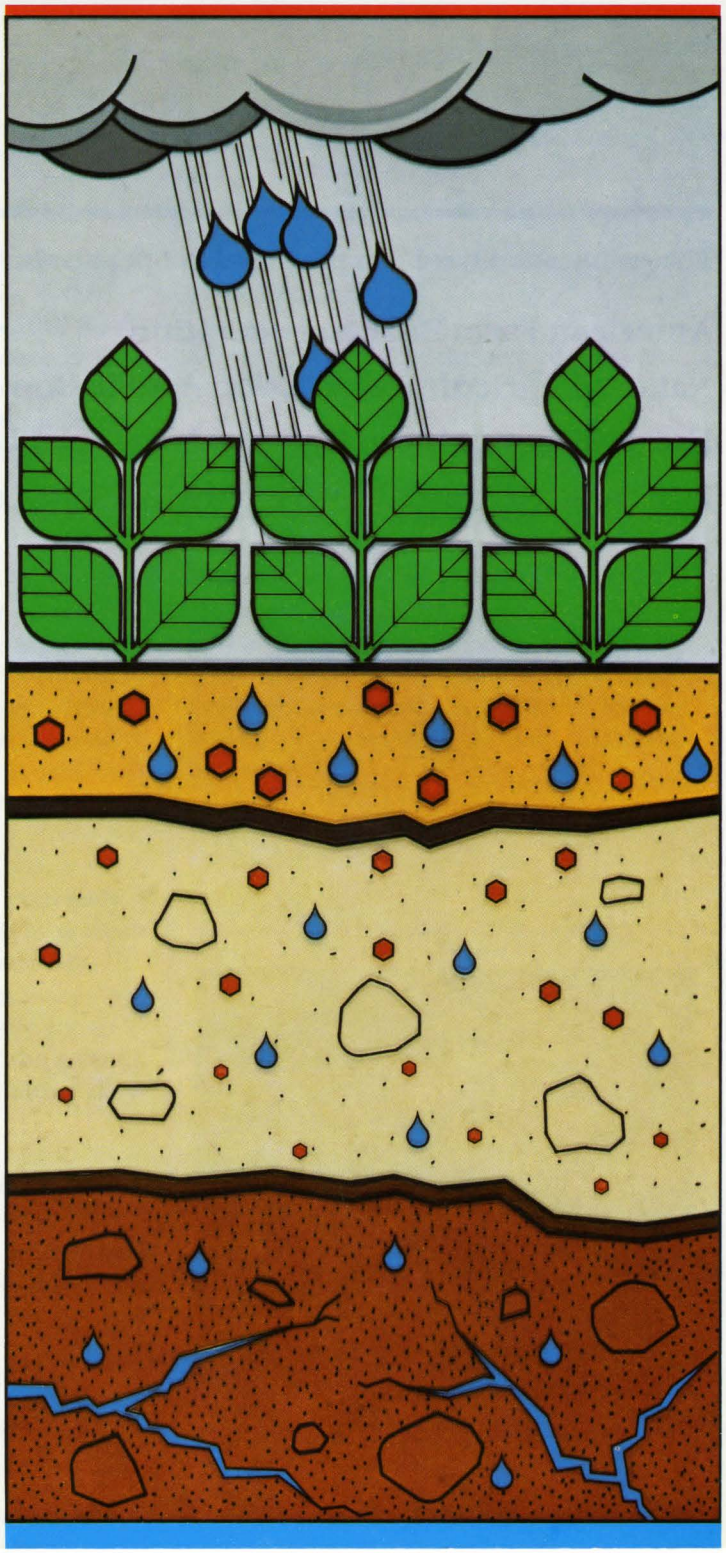
Nebraska Cooperative Extension Service EC 87-727

PROTECTING OUR GROUNDWATER

A Grower's Guide



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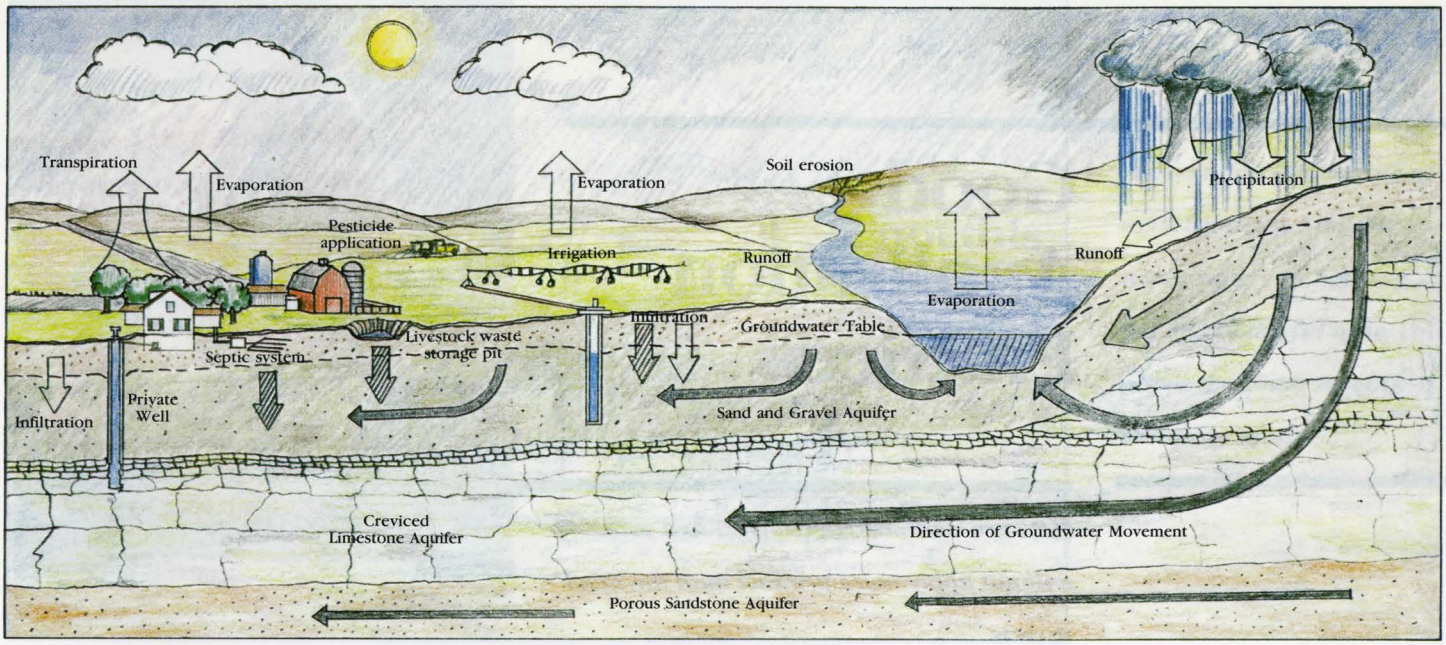


Groundwater is an essential natural resource. Half the people in the United States—90 percent of rural residents—depend on groundwater as a source of drinking water. Concern about its quality and potential contamination has made groundwater protection a national issue.

Groundwater forms when water moves below the earth's surface and fills in empty spaces in and around rocks and porous materials. If enough gathers in one area, groundwater becomes the source of fresh water supplying wells and springs. Under certain conditions, contaminants—including soil nutrients, waste products, and chemicals—can migrate into groundwater sources.

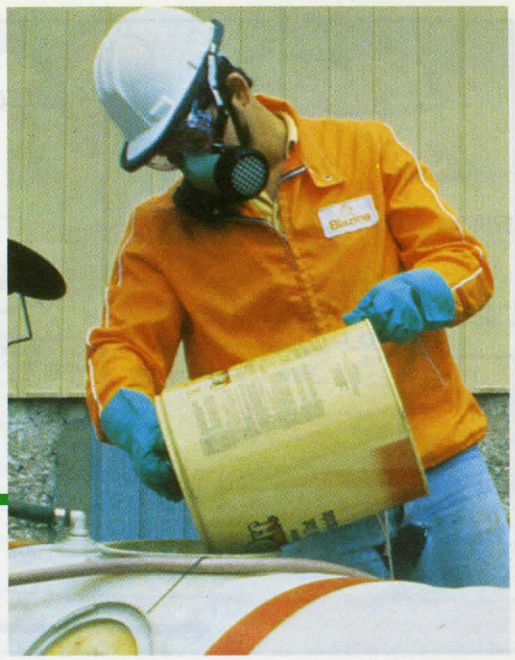
Modern technology can detect extremely low concentrations of chemicals in groundwater. One group of chemical contaminants sometimes found in groundwater is pesticides. These products usually are applied to, or near, the surface of the ground. Five major factors determine whether they will reach groundwater:

- the practices followed by the chemical applicator,
- the presence (or absence) of surface water from rain or irrigation,
- the characteristics of the product being applied,
- the type of soil in the area of application,
- the location of the groundwater—its distance from the surface and the type of geological formations above it.

Only rarely does the combination of conditions occur which allows pesticides to reach groundwater. By being aware of these considerations, you can apply these products in ways which will make the potential for groundwater contamination even less likely.

By observing some simple precautions, applicators can reduce the risk of agricultural chemicals reaching groundwater.

Good Application Practices

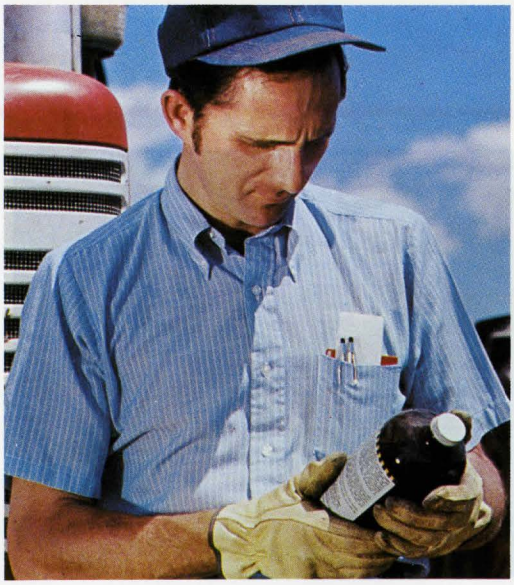


Measure and mix carefully so that you will not apply more product than the label directs.

Follow Label Directions

The best way to minimize groundwater contamination is to follow label directions exactly. The label's use instructions, approved by EPA, have been carefully developed after many years of study and testing. If you do not follow them, your treatment may not be effective, you increase the risk of contaminating groundwater, and you may be violating the law. Proper timing and placement of pesticide applications are very important.

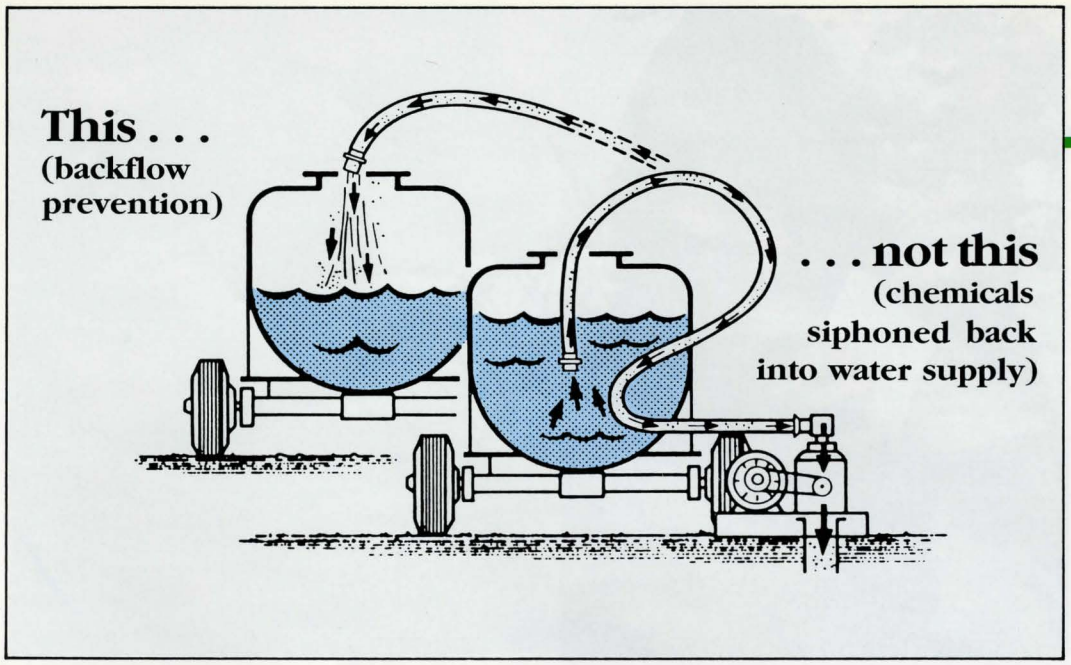
Read the product label each time before use, and follow the directions exactly.



Mix and Calibrate Accurately

Avoid the temptation to use more product than the label directs. "Overdosing" will not do a better job of controlling the pests—it will only increase both the cost of pest control and the chance that the material may reach groundwater.

Most growers do not mean to exceed recommended label rates. But field checks have shown that mistakes in preparing tank mix concentrations and in calibrating application equipment often result in the application of too much chemical. Calibrate equipment carefully and recheck it often. Measure chemical concentrates and diluents accurately before adding them to the tank. Rough approximations can lead to serious overdoses.



Prevent back-siphoning of agrichemicals into the water supply by keeping the end of the fill hose above the water level in the spray tank.

Prevent Spills and Back-Siphoning

Agricultural chemicals spilled near wells or sinkholes can move into groundwater. Be careful to avoid spills when mixing and loading. To prevent back-siphoning from spray equipment into the well, **keep the end of the fill hose above the water level in the spray tank** at all times. Use an anti-backflow device when drawing mix water directly from a well or a pond. Inexpensive anti-backflow (back-siphoning prevention) devices for hoses that are used to fill farm sprayers can be purchased from irrigation or sprayer equipment suppliers. Such devices are required by law in some areas. Both private and commercial applicators should observe these precautions.

Dispose of Wastes Properly

Improper disposal of empty containers, equipment rinse water, or unused chemicals can cause localized groundwater problems. Dispose of all wastes in accordance with local, state, and federal laws.

Triple-rinse or pressure-rinse your containers and pour the rinse water into the spray tank. If you have leftover product in your spray tank, dispose of it in a manner consistent with the product label. Avoid this situation in the first place by mixing only the quantities you need. Newer appli-

A good way to prepare containers for disposal is to pressure-rinse them, returning the rinse water to the spray tank.

Using traps to sample the level of insect population is an IPM technique which helps ensure that insecticides are applied only when necessary.

cation techniques involving chemical injection equipment and bulk handling procedures may further reduce the amounts of waste for disposal.

Do not drain rinse water from equipment near or into ditches, streams, ponds, lakes, or other water sources. Rinse waters containing any quantity of certain pesticides are classified as hazardous wastes according to federal and state laws.

Under federal law, farmers may dispose of **their own** pesticide wastes on **their own** property in accordance with the product label. But consult your state hazardous waste agency for specific state requirements.

Excess surface water due to rain or over-irrigation increases the chance of pollutants moving downward to groundwater.

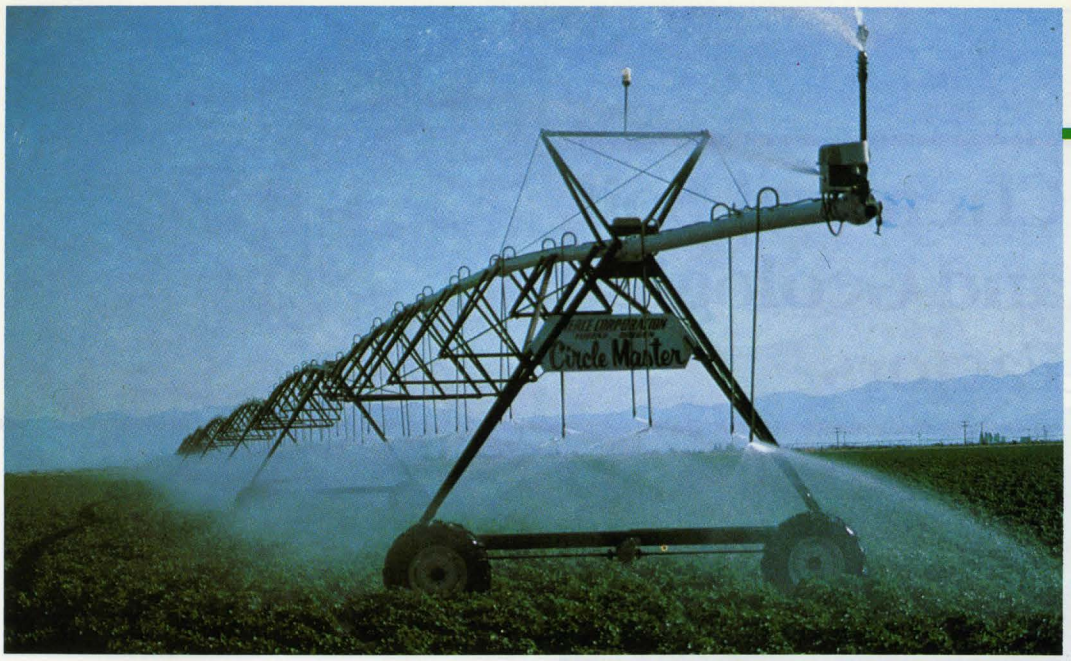
Use Integrated Pest Management

Integrated pest management (IPM) programs combine chemical use with many other production practices to manage pests in ways that are both economically and environmentally sound. These programs include such practices as crop rotation to avoid the buildup of pest populations and to maintain or improve soil conditions; the use of alternate pest control products and pest-resistant crop varieties; and careful pest monitoring to ensure that chemical methods are used only when needed.

You can get information about IPM programs from your local Cooperative Extension Service office.

Consider Surface Water

If there is more water on the soil than the soil can hold, the water (with chemicals in it) is likely to move downward to the groundwater. Prolonged heavy rain or excessive irrigation will produce excess surface water. Use weather forecasts and observations and irrigation scheduling to predict when excess surface water may be a problem.



Coordinating irrigation with application of pest control products is essential to minimizing movement of chemical residues into groundwater.

- **Weather**—Long-range weather forecasts predict the weather and probability of rain over a period of several days. Daily forecasts do an even better job of predicting the amount of rain to expect. Commonsense observations also can be helpful. If your own knowledge of local weather signs causes you to suspect heavy rain, it would be prudent to delay the application of certain products to prevent wash-off or surface runoff.

- **Irrigation**—Controlling the quantity and timing of irrigation water is also essential to minimizing chemical movement into groundwater. Be especially careful to prevent backflow into water sources, particularly if you apply pesticides through an overhead irrigation system. Do not let chemical residues leach from the tailwater pit into groundwater. Pump the pit often and reuse the water for irrigation. Do not introduce residues into underground water sources through recharge wells.

Good management techniques can help prevent chemical residues from leaching into groundwater from an irrigation tailwater pit.

Chemical, Soil, and Geological Factors

When choosing the best pest control product for the job, remember to consider how its characteristics will affect its potential for movement to groundwater.

Chemicals

Agricultural chemicals vary in their potential for moving to groundwater. Three major characteristics influence such movement:

- **Solubility**—Chemicals vary greatly in water solubility; the greater the water solubility, the more potential for movement of the product to groundwater.
- **Soil adsorption**—Some chemicals become tightly attached ("strongly adsorbed") to soil particles and do not move in the soil. Some are not so strongly adsorbed, and are more likely to move.
- **Persistence**—Some chemicals break down quickly; "persistent" materials take a long time to break down. The more persistent ones are more likely to reach groundwater over a period of time.

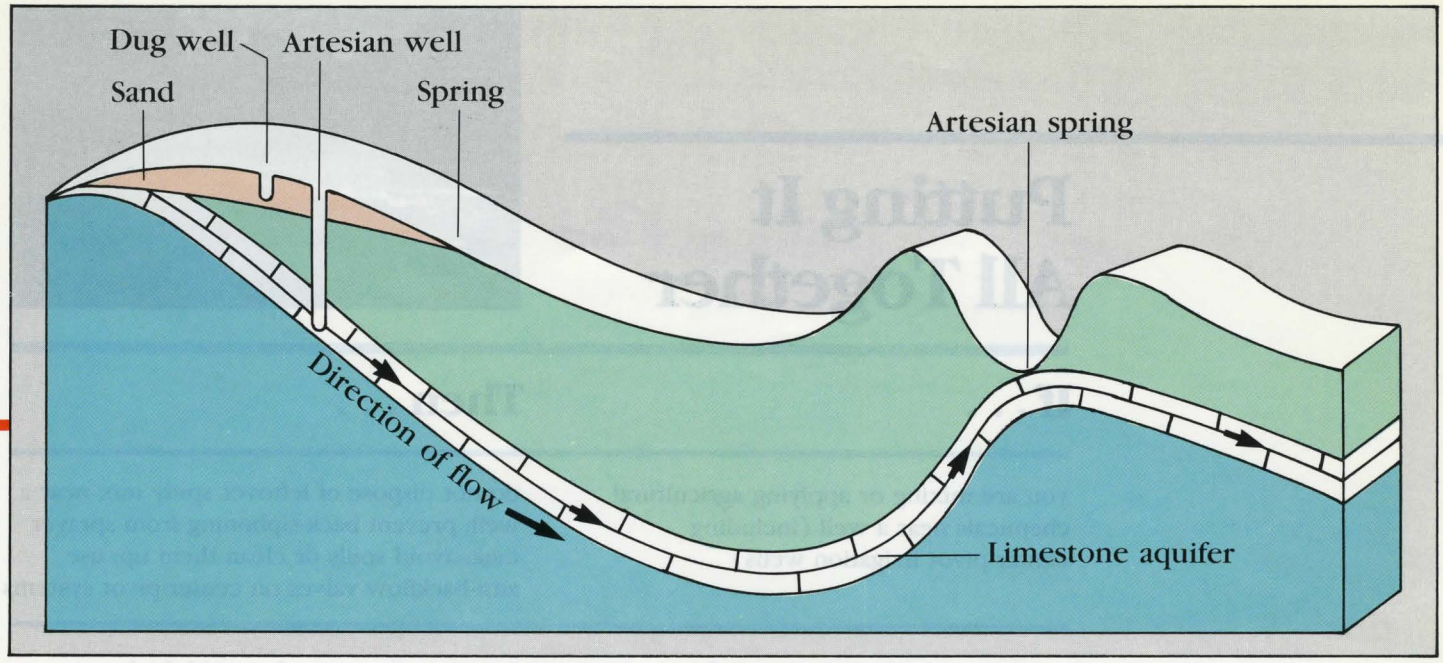
You can get more information on product characteristics from your Cooperative Extension Service or pesticide dealer.

Soil

Soil characteristics are also important in the movement of chemicals. Your local Soil Conservation Service can help you determine which types of soil are in your area.

Three major soil characteristics affect chemical movement:

- **Soil texture** is an indication of the relative proportions of sand, silt, and clay in the soil. Pest control products tend to be adsorbed mostly on clay and organic matter. Coarse, sandy soils generally allow water to move rapidly downward and offer few opportunities for adsorption. Finer textured soils generally allow water to move at much slower rates, and they contain more silt and organic matter to which pesticides and other chemicals may be adsorbed.
- **Soil permeability** is a general measure of how fast water can move downward in a particular soil. The more permeable soils must be carefully managed to prevent any form of chemical from reaching groundwater.
- **Soil organic matter** influences how much water the soil can hold before movement occurs. Increasing organic matter will increase the water-holding capacity of the soil. Some pesticides may also be adsorbed into organic matter.



Geology

Distance of groundwater from the surface is another important factor. If the groundwater is within a few feet of the soil surface, pollutants are more likely to reach it than if it occurs at greater depths.

The **permeability of geological layers** between the soil and groundwater is also important. If surface water can move quickly to the groundwater, the potential for pollutants reaching groundwater is increased.

Sinkholes are especially troublesome. Surface water often flows into sinkholes and disappears quickly into the groundwater. If a chemical is applied to an area that drains to a sinkhole, even a moderate rain or irrigation may carry some of the material directly to the groundwater.

Both the underlying geological formations and the distance of the groundwater from the surface affect the movement of surface-applied chemicals to groundwater.

Be especially careful when applying agricultural chemicals in an area where sinkholes are present, because they may allow runoff or spills to move directly into groundwater.

Putting It All Together

If . . .	Then . . .
you are mixing or applying agricultural chemicals near a well (including center-pivot irrigation wells)	do not dispose of leftover spray mix near a well; prevent back-siphoning from sprayer tank; avoid spills or clean them up; use anti-backflow valves on center-pivot systems.
you are applying agricultural chemicals on sandy soil with low organic matter content or to a field where the groundwater is near the soil surface	be aware that a product with higher water solubility, longer persistence, and low soil adsorption has a greater probability of reaching groundwater. Use the lowest effective rate recommended for this soil type. Use IPM practices whenever possible.
you are mixing or applying agricultural chemicals near sinkholes or areas draining directly into rivers or streams	remember that surface runoff or spills can wash directly into the sinkhole or the stream. Leave an adequate untreated barrier immediately surrounding the sinkhole or drainage area. Do not dispose of chemical products or waste materials in drainage areas near sinkholes, or near streams.
you need further information on soils, location of groundwater, or agricultural chemical products	consult your Cooperative Extension Service, the Soil Conservation Service, or your farm service representative or dealer for advice.