Groundwater Pollution and the Greenhouse

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Greenhouse businesses routinely handle a number of potential pollutants. Growers can reduce the potential for groundwater pollution by understanding which compounds can cause contamination and how contamination occurs.

Most growers are aware of the potential hazard associated with pesticides in the environment. Plant growth regulators, fertilizers, surfactants, dyes and biological agents can also contaminate water supplies. All of these compounds are routinely used in greenhouse crop production.

Other chemicals, such as fuels (gas and oil), cleansers and flushes (such as those used to clean boilers or equipment) and road salts, are used in the operation and maintenance of the greenhouse facility. These agents must also be regarded as potential groundwater contaminants.

This article will focus on the chemicals used in the greenhouse for crop production.

Four key elements directly influence the potential for groundwater contamination. These include the physical and chemical properties of (1) the chemical agent, (2) the soil, (3) physical, geological and climatic properties of the site and (4)the management practices employed by the grower.

Pesticides (and other crop production chemicals) differ in solubility, absorption by soil particles and persistence in the environment. Factors which favor eventual groundwater contamination include high solubility, low absorption by soil particles and long-term persistence.

Soil texture, organic matter content and structure all influence chemical movement to groundwater. Sands and gravels allow water to percolate through the soil quicker than do silts and clays, increasing the potential for contamination. High organic matter will tend to absorb or bind chemicals and will also support more biological activity than coarse, sandy soils, decreasing the risk of contamination. Soil structures containing lots of macropores, which are direct channels to groundwater, are high risks for contamination.

Directly under the greenhouse the soil may be compact, lacking cracks and worm tunnels (macropores). However, the area adjacent to the greenhouse may differ considerably. Growers should consider this factor especially if waste water is channeled out of the house and onto the adjacent land.

Greenhouses located over shallow water tables have a high potential risk of contamination. Geological features such as fractures in bedrock overlying an aquifer also increase the risk factor. High average yearly rainfalls increase the percolation through the soil and the potential to carry soluble pollutants to groundwater.

While the grower cannot change many of these factors, he/she can adopt management practices to minimize the potential impact. The key to groundwater pollution is prevention. Once contamination occurs, the remedies are expensive and difficult to achieve.

Growers must consider the potential risk factors involved when crop management decisions are made. The following list of suggestions can be used to make the correct management decision.

Site selection:

a) Evaluate and select low-risk sites for new greenhouse construction. (Contact the SCS officer in your county for help.)
b) If a low risk building site is not available growers should consider installing a recirculating fertilizer/irrigation system, or a floor drainage system and catchment ponds to capture greenhouse waste water.

Pesticides:

a) Follow label recommendations for all pesticides (including herbicides). **Use only as intended!**
b) Use insect and disease resistant plant cultivars when possible.
c) Limit contamination from pesticides by using low-risk chemicals when possible.
d) Only mix the amount of pesticide needed.
e) Save rinse water to formulate future spray applications or immediately spray rinse water over cropped area.
f) Apply chemicals directly to the target area and minimize drift or accidental contamination of nontarget areas. Do not irrigate crops immediately following a spray application as soluble chemicals will leach into the environment.
g) Use IPM (integrated pest management) practices and biological control when available.
h) Rinse empty containers and dispose of properly.

Plant growth regulators:

a) Use cultivars which do not require PGR to attain the desired growth form.
b) Use cultural control–i.e. water, fertilizer, temperature, to control plant height and form.

Nutrients:

a) Limit leachate from potting medium to 10% or less.
b) Use drip irrigation, water trays or recirculating systems when economically feasible.
c) Use slow-release formulations when possible, alone or with a liquid feed.
d) Feed adequate amounts of nitrogen (not luxury amounts).
e) Incorporate 10% mineral soil to limit leaching of nutrients.

Staging and storage:

a) Store chemicals in a safe location and out of the weather.
b) Mix and rinse chemicals away from environmentally sensitive locations, i.e. the wellhead or aquifer draw-down area.
c) Use containment in mixing and storage areas–a cement apron or a liner to contain spills, also keep absorbant material on hand in case of spills (See CES bulletin SEG-93, *Pesticide Storage*).

Others:

a) Restrict use of dyes and surfactants when possible.
b) Use back flow preventers (i.e. anti-siphon devices) on all water lines used for mixing or delivering potential contaminants.