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^eNewsletter

WWW.Watershed-Alliance.org A coalition of interested parties dedicated to provement of water quality in West-Central Indiana and



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Home Gardening Issue

Spring is in the air. The miles-long flock of grackles have migrated north. Red-wing blackbirds have returned to the area. And gardeners are thumbing seed catalogues itching to start their work.

This issue is dedicated to the home gardener. Although developed areas of the WCIWA are relatively small (7-10%), home gardening activities can have a significant impact on surface water quality. Studies in the Chesapeake Bay area have shown that medium and highdensity developments deliver more fertilizers and pesticides per acre than any other land use in that region.

Because of the sheer volume of agricultural land use (over 65% of the WCI-WA), Best Management Practices adopted by watershed groups relate directly to commercial farming operations. Many of these practices be applied to the home garden. And all of the chemical handling precautions taken by the regions growers should also be taken by the gardeners.

In 2011, groups representing fertilizer manufacturers launched the 4Rs concept of nutrient management. This same concept can be applied to pest management. And both can - and should - be adopted by home gardeners.

Right Product

Perform soil tests and crop scouting to determine what - *if any* - products are needed.

Right Rate

Follow label instructions when mixing and applying products. Calibrate equipment to insure accurate applications.

Right Time

A little homework will tell you when plants are actively growing and their uptake of nutrients is most efficient. Pesticide labels will provide information on drying times, temperature limitations, etc.

Right Place

Avoid sidewalks, streets, surface waters and other areas where run-off and leaching is likely.

Home Fertilizers, Pesticides and Water Quality

One might ask why a single family with only a home lawn or garden should be concerned about the effects of their activities on water quality. The reason for concern is that the effects are not always confined to their land.

Soil is a common pathway to groundwater, and soil characteristics determine the rate at which chemicals move through it. In addition, surface water run-off has the ability can carry chemicals and fertilizers from gardens and lawns either directly to creeks and lakes, or enter the same surface waters via storm sewer systems.

Thus, you should be sensitive to the off-site effects caused by the whole neighborhood's activities.

Although developed areas of the WCIWA are relatively small (7-10%), home garden activities can have a significant effect on surface water quality. Studies in the Chesapeake Bay area have shown that medium and high-density developments deliver more fertilizers and pesticides per acre than any other land use in the region.

Simple homeowner precautions can protect water resources.

FERTILIZER

Perform soil tests *before* fertilizing. It is likely that phosphorus, a common cause of algal blooms and fish kills, is not required for plant health, especially in lawns.

It is very important to follow label instructions carefully and mix fertilizer accurately. When watering lawns after fertilizing, do not allow water to run into streets, ditches, creeks or lakes.

Use caution on slopes and lawn edges to prevent fertilizers from washing into storm sewer systems or surface waters. Always *sweep* up spilled fertilizer. Never apply to frozen ground or dormant plants. BeOilseed Radish planted between rows of tomatoes. Image courtesy of TendingMyGarden.com

Cover Crops in the Home Garden

Most home gardeners seem to think that planting cover crops is something only farmers do. Information on use of cover crops is typically tailored to the needs of farmers working on large acres. But when you measure your cropping space in feet rather than acres and your main tools have wooden handles, you need a special set of cover crop plants and special methods for using them.

A cover crop is any plant grown for the primary purpose of improving soils. Cover crops, also known as green manures, are an excellent tool for vegetable gardeners, especially where manures and compost are unavailable. They lessen soil erosion during the winter, add organic matter when turned under or used as mulch in the spring, improve soil quality, suppress weeds, and create and cycle soilborne nutrients. Advances in soil biology continue to reveal additional ways that cover crops can improve soil.

Root Zone Symbiosis

Many plants release sugars and other substances through their roots. Thanks to the release of these sugars, the root tips of many plants host colonies of helpful micro -organisms. As the roots move deeper, the micro-organisms follow: up to 5 or 6 foot for oats and rye.

Symbiotic relationships between growing roots and biologically diverse soil organisms can help plants obtain nutrients from surrounding soils, consequently enriching nutrient availability for following vegetables. The improved populations and diversity of soil organisms can also assist following crops. For example, in a mycorrhizal association (fungus + plant roots), soil fungi colonize roots, improving the plant's uptake of both moisture and nutrients.

In addition to promoting biodiversity in the soil systems, decaying cover crop roots deposit organic matter at levels far deeper than traditional tilling or double digging methods can. One can think of the process as underground composting. Just as the most effective composting requires a balanced mix of browns to greens (Carbon to Nitrogen), the most effective organicbuilding cover crop routine will use high carbon plants such as rye following high nitrogen plants such as radishes following high carbon plants like sweet corn.

Bio-drilling

Some cover crops, such as oilseed and daikon radish can be used for their natural

ability to penetrate compacted soil layers. Their aggressive tap roots will drill through subsoil layers, reaching depths of 32" or more. The radishes used specifically for cover crops are typically winter-killed and their decomposed root structures leave organic-rich channels that are used by following crop to penetrate deeper compaction layers. This bio-drilling serves as a form of tillage and can reduce crop stress by improving access to deeper soil moisture and nutrients.

Soil Structure / Health

Most home gardens are aggressively tilled. Tillage has a negative impact on soil flora and fauna, especially the fungal networks that are critical to maintaining soil structure. Glues that are secreted when both actively growing roots and fungal

networks are present in the soil have the ability to Cover crops have soil aggregates together, the ability to maintaining the pore improve soil quality, space necessary for infiltration of rain and adequate oxygen for root and and cycle soilorganism growth. The win- borne nutrients. dow of opportunity for

fungal-root networks to develop soilbuilding glues is expanded by providing the soil ecosystem with actively growing cover crop roots during normally fallow seasons.

Tillage also has a negative effect on soil organic matter. Similar to the rusting of exposed iron, the blast of oxygen from tillage operations oxidizes soil-borne carbon, resulting in organic matter losses. Use of cover crops can slow organic matter losses. When combined with mulch or lasagna-style gardening systems, organic matter can even be increased. And as any

gardener knows, soils with high organic matter are richer in nutrients, water availability for growing plants, and general soil health.

Pest Suppresion

Many cover crops can be utilized for specialized characteristics. Quick-growing crops such as buckwheat are excellent for weed suppression. New studies are showing promise for the use of cover crops, especially mustards and brassicas for suppression of soil pests.

This group of cover crops has been shown to release biotoxic compounds or metabolic byproducts that exhibit broad activity against bacteria, fungi, insects, nematodes, and weeds. Brassica and mustard cover crops are often mowed and incorporated to maximize their natural fumi-

> gant potential. This is because the fumigant chemicals are produced only when individual plant cells are ruptured.

Taking Down

Taking down cover crops can be the most trying of their incorporation into a home

garden. Because of that, it's a good idea to add new cover crop varieties to your garden in small plots.

Cover crops should be terminated before reaching maturity and potentially creating a seed bank of unwanted plants. Traditionally, cover crops are incorporated into the soil. Alternatively, they may be mowed, chopped, or pulled and used as a weed-suppressing / water-conserving mulch.

When planning cover crop termination, it is equally important to plan the timing of the following vegetable crop to avoid pocause lawn clippings contain phosphorus, do not direct hem into streets.

PESTICIDE MANAGEMENT

When applying herbicides, insecticides, and other pesticides, always read the label carefully. Use the lowest effective rate for a single application. The thought that "if a little will do a little good, a lot will do a lot of good" is a fallacy.

Calibrate sprayers and dry applicators to insure that you apply correct rates. Only mix the amount you will use in one application. When finished, thoroughly clean equipment, but do not dump rinse water in the street (where it can reach storm sewers) or in a single place where it can become concentrated - and become a pollutant.

Always allow for the drying time listed on the label and never apply chemicals before a heavy rain. As with fertilizers, do not let run-off enter surface waters. Many commonly used pesticides or their carrier agents are toxic to fish and aquatic life, including:

- Carbaryl
- Malathion,
- Benfluralin (BALAN)
- 2.4-D
- Dacthal
- Dicamba (Banvel)
- Glyphosate (Round-up)
- Mecoprop (MCPP)
- Pendimethalin (Prowl)
- Trifluralin (Preen)

Follow the lead of farmers: scout for weed and insect pressure before applying pesticides. Stay back from any ditches, creeks or lakes. Use filter strips along those surface waters. For homeowners, filter strips can landscaped areas consisting of native flowers and grasses, perennial beds, and trees or shrubs.

These urbanized filter strips can have the added benefit of bank reinforcement: Their roots act like rebar in concrete, helping to prevent erosion losses during high flow events and wave action.

suppress pests,

Playing the C:N Game

Carbon to Nitrogen ratio (C:N) is a ratio of the mass of carbon to the mass of nitrogen. Since the C:N ratio of everything in and on the soil, it can have a significant effect on crop residue decomposition and crop nutrient cycling,

Management of these ratios can improve soil health and economic productivity. Resulting decreases in soil and nutrient losses also have the benefit of improved water quality

24:1 Rules the Soil

Soil microorganisms have a C:N ratio near 8:1. To acquire the carbon and nitrogen a soil microorganism need to stay alive, it needs foodstuff with a C:N ratio near 24:1. It is this C:N ratio (24:1) that rules the soil!

Feeding the Soil Community

If foodstuff such as mature alfalfa hay (C:N = 25:1) is added to the soil, the soil microorganisms will consume it relatively quickly with essentially no excess carbon or nitrogen left over.

When fed something with a higher C:N ratio like wheat straw (80:1) the soil microorganisms will have to find additional nitrogen to go with the excess carbon in order to consume the wheat straw. Conversely, a food source with a lower C:N ratio like a hairy vetch cover crop (11:1) will allow the soil microorganisms to consume the vetch and leave the excess nitrogen in the soil.

Everything else being equal, materials added to the soil with a C:N ratio greater than 24:1 will result in a temporary nitrogen deficiency and those with a C:N ratio of less than 24:1 will result in a temporary nitrogen surplus.

Effects on Soil Cover

The faster crop residues are consumed by soil microorganisms, the less time those residue will be covering the soil surface. While it is important to maintain

soil cover - to reduce erosion and provide good earthworm habitat - it is also essential that tentially negative reactions with rotting plant residues. For example, fresh sorghum-sudan residue will inhibit the grown of tomatoes, lettuce, and broccoli; and cereal ryes are known to produce allelopathic compounds that inhibit germination of some seeds.

Common Cover Crops

Cereal Rye (Winter Rye)

• Hardy through Zone 3

- Nutrient Scavenger, Subsoiler, Soil Builder, Weed Fighter
- 2-3lbs / 1000sf
- Mow or crimp at milk or dough stages

Oats (Spring Oats)

- Hardy through Zone 8
- Erosion Preventer, Weed Fighter
- 2-3lbs / 1000sf
- Winter kill

Sorghum-Sudangrass

- Not frost tolerant
- Nitrogen Scavenger, Soil Builder, Erosion Preventer, Weed Fighter
- 1-2lbs / 1000sf
- Winter kill

Wheat

- Hardy through Zone 4
- Erosion Preventer, Weed Fighter
- 2-3lbs / 1000sf
- Mow or crimp at milk or dough stages

Crimson Clover

- Hardy through Zone 6
- Nitrogen Source, Soil Builder
- 0.5-1.5lbs / 1000sf
- Till, herbicides

Hairy Vetch

- Hardy through Zone 4
- Nitrogen Source
- 1.5-2lbs / 1000sf
- Mow or crimp at full bloom

Winter Pea

- Hardy through Zone 7
- Nitrogen Source
- 2-3lbs / 1000sf
- Mow

Brassicas and Mustards

- Hardy through Zone 8
- Nitrogen Scavenger, Subsoiler, Soil Builder, Weed and Pest Fighter
- 0.125-0.25lbs / 1000sf
- Winter kill, Till

Buckwheat

- Not Frost Tolerant
- Weed Fighter, Phosphorus Builder
- 0.125-0.25lbs / 1000sf
- Winter kill, Chop

*Note: In most cases, tillage or herbicide treatments may be used for cover crop termination.

Resources

Many excellent sources are available to help with cover crop selections. Recommended volumes:

<u>Midwest Cover Crops Field Guide</u> available from Purdue University Extension for \$5.00

<u>Managing Cover Crops Profitably</u> available through SARE (Sustainable Agriculture Research and Education may be downloaded in .pdf for free or purchased in book form for \$19.00

The Cover Crop Decision Tool available from the Midwest Cover Crop Council website (www.mccc.msu.edu) is an excellent resource for cover crop selection.

Mulch Gardening

Images of No-Till / Mulch Gardening by Lee Reich

A growing number of gardeners are turning away from intensive tillage systems to control weeds and adopting mulch or lasagna gardening.

The crux of this style of no-till gardening is to pile on enough mulch to keep weeds from germinating and growing up through it. If you use leaves, grass clippings or straw, you might need as much as eight to ten inches of mulch.

Just like a recipe, the ingredients to start a no-till garden can be varied and embellished. The following directions will make an approximate 4ft x 4ft garden

- 40 Sheets of Newspaper
- 5 gal bucket of water, 2/3 full
- 40 lb composted manure
- 1 garbage bag chipped wood

- 1 garbage bag of grass clippings
- 1-2 gal good garden or potting soil
- Water

Flatten or mow future beds as low to the ground as possible. Put newspapers in bucket of water to completely wet. Open paper and lay on ground 4-6 sheets thick, overlapping edges. (This becomes the weed barrier and will eventually compost)

Spread composted manure on top of paper to attract worms and other beneficial soil organisms.

Spread the following layers in order:

- 2-4" Wood chips (This layer should be course enough to allow air circulation.
- Water
- Dried Leaves



Winter wheat plantings between Asian Greens. The winter wheat can tolerate some foot traffic

Image: University of Maryland Extension

residues decompose to release plant nutrients and build soil organic matter.

	SLOWE	R
laterial	C:N	
ye Straw	82:1	
/heat Straw	80:1	L
at Straw	70:1	
orn Stover	57:1	
ye Cover (Headed) 37:1	
ea Straw	29:1	
ye Cover (Veg.)	26:1	
lature Alfalfa Hay	25:1	
leal Microbial Diet	24:1	
otted Barnyard	20:1	
anure		Ċ
egume Hay	17:1	
eef Manure	17:1	
oung Alfalfa Hay	13:1	Γ
airy Vetch Cover C	rop 11:1	
oil Microbes (Ave.)	8:1	
	FASTER	

С

R

В

Cover Crop Influence -Balance the Highs with the Lows

Cover crops added to a crop rotation can help manage nitrogen and crop residue. A low C:N ratio cover crop containing legumes (such as Austrian Winter Peas) and/or brassicas (like Tillage Radishes) can follow a high C:N ratio crop like corn to help the break down of residue and release of nutrients for the next crop. Similarly a higher C:N ratio crop (like Rye) can help provide soil cover after a low residue, low C:N ratio crop like lettuce, yet decompose during the next growing season to make nutrients available to the following crop.

Safe Chemical Storage & Disposal

From Ohio EPA and Virginia Extension Pesticides Factsheets

Most pesticides are designed to work on a wide number of pests. This can make the pesticides harmful to useful insects, animals and plants as well. Throwing pesticides in the trash, on the ground or pouring them down the drain can pollute lakes, streams and drinking water.

CAREFULLY read the label before buying or using any pesticide. Make sure you buy the proper pesticide to use on the "pests" you wish to control. Buy only as much as you need so there won't be any leftover to store or dispose.

Each different type of lawn and garden chemical poses its own particular disposal problem. Fertilizers are often stored year after year with little fear of problems. However, to be stored safely, they should be kept locked in a cool, dry place, in their original, labeled containers. Many fertilizers can be a fire and explosion hazard, as well as a threat to the groundwater supply.

These rules hold for pesticides also, but there are other points to consider when dealing with these chemicals. Common sense says you should use extreme care not only in their use, but in their storage and disposal as well. It cannot be overemphasized that most pesticides are poisonous and should be kept locked up and out of reach of children, pets, and others! Never store them near food supplies, in a tool shed or well house, or near a living area. The results could be disastrous.

- Water
- Grass Clippings
- Water

You may plant into this garden right away or allow the layers to compost. To plant seeds immediately, open a furrow in the layers with a hoe or rake, spread in a one inch deep strip of soil, lay the seeds on the soil and cover with the recommended amount of additional soil. To transplant, simply open a hole in the layers, set the plant in and pull the mulch back up around it.

For the first year or so, you may need to dig out old roots and add a little topsoil or compost in the hole where you wish to plant. As with the first year, when you are ready to plant in the spring, push the mulch layer aside just where you wish to place seeds or starts.

If weeds begin to sprout, add layers of mulch, such as straw or grass clippings to smother the unwanted plants.

Over time, the mulch layers you keep

adding will form enough soil to support your garden. And the soil formed by the addition of so much organic matter will likely to be loose, full or earthworms, and teeming with the healthy microbes that make nutrients available to your plants. When one of your crops is finished, incorporate the dead vegetation into the mulch layer.

As with commercial no-till farming, soil health, structure, nutrient availability, and drainage will improve over time. No-till adoption by commercial growers and gardeners alike will reduce surface water sediment loads by reduction soil erosion. Notill will also reduce nutrient loads in surface waters. The addition of cover crops into this no-till or mulch gardening system will further accelerate soil health

Sources:

The Ugly Gardener, IA Backyard Conservation OSU Extension Service Weedless Gardening by Lee Reich

WHAT IS A CLOD??



Organic residues act like sponges, absorbing water and soil nutrients, cushioning soil particles. Clods act like bricks, resisting water absorption and making soils hard and compacted. Some gardeners complain that their soil is cloddy and hard to work. Clods are manmade and do not usually exist in the natural world. Bricks and clay tile are formed by taking wet clay from the soil, and heating and drying the clay. When farmers till the soil, they perform the same process by exposing the clay to sunlight, heating and drying the clay until it gets hard and turns into a clod. Tillage also oxidizes the soil and results in increased microbial decomposition of organic residues. Organic residues keep clay particles from chemically binding. Clay soils that remain protected by organic residues and stay moist resist turning into clods because the moisture and organic residues keep the clay particles physically separated.

What Lives in the Soil and What are They Doing?

From the University of Minnesota Extension Publication "What Live in Your Soil?"

Like the above ground ecosystem, the soil community is not just a collection of individual species, but a complex, interacting food web. Decomposition of a single compound may require several organisms. The creation of aggregates involves a mix of physical and chemical processes and the activity of many types of organisms.

Each type of soil organism fills a unique niche and plays a different role in the cycling of nutrients, the structure of soil, and in pest dynamics.

BACTERIA

Usually single-celled

Diet:

Organic matter, especially simple carbon compounds.

Typical Amount in Ag Soils:

100 million to 1 billion in a single teaspoon

Action in Soil:

- Decompose organic matter
- Immobilize nutrients in the rooting zone
- · Rhizobium and other genera fix nitrogen from the air
- · Convert ammonium to nitrate and nitrate to nitrogen gasses.
- Actinomycetes, which grow as filaments, are important in decomposition at moderate to high pH
- Create substrates that help bind soil aggregates

FUNGI

Grow in long filaments called hyphae Diet:

Organic matter, especially simple carbon compounds. Also living plants Typical Amount in Aq Soils:

Several yards in a single teaspoon Action in Soil:

- Decompose organic matter
- Immobilize nutrients in the rooting zone.
- Mycorrhizal fungi form mutually beneficial associations with roots. They release acids that help make phosphorus more available to plants.
- Help stabilize soil aggregates

PROTOZOA

Single-celled animals

Diet:

Primarily bacteria

Typical Amount in Aq Soils: Several thousand in a single teaspoon Action in Soil:

- Stimulate and control bacterial growth
- Release ammonium

NEMATODES

Roundworms. Not segmented as are earthworms.

Diet:

Bacteria, fungi, protozoa, other nematodes, and roots.

Typical Amount in Ag Soils: 10 to 20 in a single teaspoon

Action in Soil:

- · Control many disease-causing organisms.
- Root-feeders may cause root diseases.
- Release ammonium

ARTHROPODS

Includes insects, mites, spiders, springtails, and millipedes

Diet:

All other organisms Typical Amount in Ag Soils: Several hundred in a cubic foot Action in Soil:

- Shred plant residue, making it more accessible to bacteria and fungi.
- Enhance soil structure by creating fecal pellets and by burrowing.
- · Control populations of other organisms.

EARTHWORMS

Diet:

Bacteria, fungi, and organic matter Typical Amount in Ag Soils:

5 - 30 in a cubic foot

Action in Soil:

- Shred plant residue.
- Enhance soil structure by burrowing, mixing, and creating fecal pellets
- Transport and stimulate growth of bacteria.

Storing Pesticides Safely

Keep pesticides in their original containers. If the original container is damaged, place the container inside a larger container sealed with a plastic lid (zip-lock baggies work well), a box lined with two plastic bags, or a metal container with a lid.

Clearly label the outside of the container with the name and quantity of the pesticide and the date. Always try to keep the original label if possible.

Store pesticides in a dry, locked cabinet or on a high shelf away from children and pets.

Keep pesticide containers from getting wet or frozen.

Proper Pesticide Disposal

Use all of a pesticide before buying more.

If you can't use all of a pesticide yourself, find someone who can. Contact neighbors, friends, greenhouses, plant nurseries, park departments and garden clubs. Make sure any pesticides you give away are in their original containers with readable instructions.

Empty pesticide containers should be rinsed at least three times. Use the rinse water as you would the regular strength pesticide. You can put the rinsed container in the trash.

Pesticides that cannot be used should be taken to a community household hazardous waste collection event. Call your local solid waste management district for information (located in the blue pages under County Government in your phone directory).



Technical & Advisory Committee Meeting

The next regularly scheduled meeting is :

- Tuesday, May 15th USDA Service Center 2316 N Section St
- Sullivan, IN

Events and Important Dates

• Ongoing

Self-guided Cover Crop Tour. Download GuideBook at www.Watershed-Alliance.org

• Friday March 23rd

Septic Workshop for Realtors, Contractors - *Camp Wabashi, Terre Haute* Download information and registration at www.Watershed-Alliance.org 4 Continuing Education Credits for Real Estate Professionals

• Saturday March 31st

Sullivan Ag Day - Sullivan County Fairgrounds

• Friday, April 6th

Conservation Reserve Program General Sign-up 43 ends.

• Saturday, April 28th

Operation Medicine Cabinet - National Unwanted Medicine Collection Campaign Contact your local SWCD or Law Enforcement Agency for collection sites near you.

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West Central Indiana Watershed Alliance

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