PennState Extension

Armoring Your Fields to Avoid Erosion

Soil erosion continues to be a concern on our cropland. The four types of soil erosion are discussed, what they mean, and what to do about them.

ARTICLES | **UPDATED: SEPTEMBER 4, 2019**

Ephemeral gully erosion in a no-till field. When rills or gullies are observed the tolerable soil loss level is already exceeded. Photo credit: Sjoerd Duiker

Soil erosion by water is still the major source of soil degradation in the world, in the USA, and in Pennsylvania as well. This is true despite almost 100 years of soil conservation efforts in our nation. Our understanding of the processes of soil erosion have increased dramatically due to research started in the 1930s and continued up to this day.

Conservation practices have been developed and tested. Concerted efforts of USDA-NRCS, Soil and Water Conservation Districts, Crop Consultants, Agribusinesses and Cooperative Extension working in partnership with farmers have resulted in much progress to implement BMPs to stop erosion in its tracks. According to the 2015 National Resource Inventory (NRI) *average* soil erosion by water on U.S. cropland decreased from 3.82 T/A/yr in 1982 to 2.71 T/A/yr in 2015.

This is a major achievement, but still represents (together with wind erosion) almost one billion tons of soil washing off our nation's croplands. And the average hides

the fact that there is still a lot of land where the estimated annual soil loss is greater than the Tolerable Soil Loss 'T', representing a level of erosion that will permit current production levels to be maintained economically and indefinitely. In fact, according to the 2007 NRI, there were 99 million acres (almost 1/3rd of U.S. cropland) that were still eroding at levels exceeding T. This becomes the more urgent for our state where 60% of cropland is Highly Erodible, where total precipitation has been increasing, and where the intensity of rainfall has been increasing as well.

So what needs to be done? First, as much as possible, erosion needs to be stopped where the raindrop hits the ground to 'stop erosion in the bud'. This means stopping the first stage of erosion called interrill or sheet erosion. This level of erosion is basically invisible to the eye and therefore so insidious. Keeping soil covered at all times is the most important thing you can do to reduce interrill erosion. Today we have a great opportunity to achieve just that by using continuous no-till practices, making sure enough crop residue is left to cover the soil. Cover crops will be needed for interrill erosion control where insufficient residue is left after harvest of some crops – especially crops such as corn silage, double cropped soybeans, and even full-season soybeans.

Leaving soil undisturbed also means it is less likely to be dislodged and transported. Improving soil health to improve aggregate stability and macroporosity is another important way to reduce interrill erosion because it reduces the amount of soil splash and runoff. This is where increasing organic matter, promoting activity of biological organisms such as earthworms, dung beetles, protozoa, decomposer and mycorrhizal fungi and decomposer bacteria come into play.

Controlling soil compaction is another important practice to avoid reduction of water infiltration. Integrating perennials in crop rotations is another great way to improve soil health, as is planting cover crops.

But sometimes we can still get runoff that, when it concentrates in rivulets can cause rill erosion. Rill erosion is where concentrated flow starts to eat away at the soil matrix due to the scouring action of runoff. Rills are normally about 4 inches deep. Rills don't interfere with normal field operations, but, when we see rills in the field it is a sign that 'T' is already exceeded. So it is paramount to avoid rills from forming.

This can be achieved by planting (narrow-spaced) crops on the contour so that surface runoff is slowed down and given more time to infiltrate, by having large

amounts of crop residue at the soil surface, by having root systems holding soil in place. Conservation practices to reduce rill formation include strip cropping, where high-residue or forage crops planted on the contour are alternated with low-residue crops, terraces that are cropped bunds that allow water to pond behind them giving it time to infiltrate, and narrow contour buffer strips designed to slow down runoff and filter out soil.

When rills grow in size to depths up to 18 inches they are called 'ephemeral gullies'. These gullies do interfere with field operations, but can still be filled in by normal tillage operations. The final step is 'classical gullies' that are deeper than 18 inches and need major repair work beyond normal tillage. Current estimates of soil erosion do not include these types of erosion (that is, they only include interrill and rill erosion). Unfortunately, there are increasing reports of ephemeral gully erosion on our cropland. Even long-term no-till farmers have mentioned to me that they saw small gullies form on their fields in the high precipitation year of 2018.

If nothing is done to address them, they will only grow bigger in size so it is very important to address them. We need to better understand the conditions causing ephemeral and classical gullies so we can avoid them from forming.

A practice that is often recommended to 'heal' a repaired gully is a grassed waterway. It is probably safe to say that farmers would prefer not to use grassed waterways because they take working farmland out of production, need to be protected from application of herbicide or tillage operations, and also need occasional maintenance.

Nonetheless they may be necessary where gullies continue to come back in crop fields. Protecting our croplands from erosion is still of foremost importance to maintain the productivity of our soils and the quality of our streams. Remember the four types of erosion – interrill (or sheet) erosion, rill erosion, ephemeral gully erosion, and classical gully erosion, and remember that once you see rills the tolerable soil loss level is already exceeded so urgent action is called for.