River Raisin Phosphorus Modeling Frequently Asked Questions

How were these results produced?
Researchers at the University of Michigan and Ohio State University built a model of the River Raisin watershed using the Soil and Water Assessment Tool (SWAT). They calibrated the model with observed data on stream flow, sediment loading, and phosphorus loading to produce a reliable baseline representation of the current state of the watershed[1]. The researchers then simulated a broad range of scenarios, including combinations of cover crops, crop rotations, and nutrient application methods, across the entire watershed and stored the results in the database. Developers at Michigan State University then built the online tool allowing users to interact with those results at field scales.

Why do reduced tillage and no tillage scenarios sometimes results in an increase in phosphorus runoff?
Conservation tillage strategies can concentrate nutrients in the upper layer of the soil, leaving more phosphorus available for surface runoff even though less sediment is lost. The additional crop residues typically accompanying such strategies can also create more opportunities for organic forms of phosphorus to runoff. The underlying SWAT model may not fully capture the benefits of soil health practices and the researchers are continuing to work in this area."

Why does applying phosphorus before planting as opposed to post-harvest sometimes result in an increase in phosphorus runoff?
In the before planting scenarios, phosphorus was applied in early May. In the post-harvest scenarios, phosphorus was applied in early October. Over the 2001 through 2010 period for which the simulations were run, May experienced more precipitation than October, creating more opportunities for surface runoff.

Why do winter-kill cover crop scenarios have a much smaller effect on phosphorus runoff than perennial scenarios?
In preliminary testing, and as shown by other research, winter-kill cover crops (simulated with a radish cover crop), were not shown to be particularly effective for phosphorus reduction. However, the perennial scenarios (simulated with a cereal rye cover crop) were quite effective for reducing phosphorus. Rye provides more cover over bare soil throughout the winter and spring than radish, thereby reducing soil erosion and decreasing the likelihood of phosphorus leaving the field while attached to sediment. Rye also does a better job of absorbing phosphorus from the soil, leaving fewer nutrients available for runoff.

Why does applying phosphorus "less frequently" sometimes result in an increase in phosphorus runoff?
In the model simulations, less frequent applications of phosphorus meant that the nutrient was applied every other year at a rate roughly double the annual application rate. It does not imply that the total amount of phosphorus applied over multiple seasons is cut in half. On fields with higher slopes, the higher rate of application in one year may produce a large enough single year loss of phosphorus through surface runoff to outweigh the lesser loss value expected in the following year when no phosphorus is applied.

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[1] https://elibrary.asabe.org/azdez.asp?AID=48674&t=2

When simulating a rotation with wheat, what does the phrase "wheat tilled like corn" mean?
To cut down on model run time, there are two options for tillage of wheat in rotation. If your tillage operations for your wheat resemble your corn tillage operations in terms of intensity or timing (before planting/after harvest) then you should select that your wheat was tilled like corn in the rotation. If your tillage operations for wheat resembled soybean tillage operations, you should select wheat tilled like soybean. If you till your corn, soybean, and wheat similarly, either answer will work.

What are the assumptions of the filter strip scenarios?

1. The filter strip covers 2% of the area of the field where it is implemented. (e.g. a 100-acre field has a 2-acre filter strip)
2. We assume 50% of the field area drains to the most concentrated 10% of the filter strip's area. (e.g., continuing from above, a 0.2-acre area of the filter strip receives a concentrated flow coming from 50 acres from the contributing field).
3. We also assume that 25% of the flow that reaches the concentrated area of the filter strip will flow through unimpeded. (e.g. continuing from above, 25% of phosphorus in the flow from the 50 acres that is reaching the 0.2-acre concentrated area of the filter strip will not be trapped, 75% of the P will be trapped).