

MSB Progress Report on Nutrient Loss in Runoff - Do Cover Crops Make It Better or Worse?

August 2022

Seasonal analysis of N and P forms in runoff.

Most activities for this project occur during the fall winter and spring when cover crops are in the field. This year's grant began about the time we were removing our metal runoff weirs from the field in preparation for soybean and corn planting in April. Most of our effort since then has been directed toward analyzing the hundreds of runoff water samples that we collected during the winter. An important advance we are making this year is that we are digesting the runoff samples to determine the *total* phosphorous and nitrogen dissolved in them and not just the inorganic phosphate-P and nitrate-N. This digestion involves "cooking" the samples in a strong alkaline persulfate mixture heated to 120 degrees Celsius under pressure in an autoclave. Generally, it is considered that the difference between the total nitrogen or phosphorus measured after digestion and the phosphate-P or nitrate- and ammonium-N measured before digestion represents organic nitrogen or phosphorus:

Total P – inorganic Phosphate P = Organic P

Total N – (Ammonium + Nitrate N) = Organic N

The results of analyzing several hundred samples collected during the winter show that organic forms represent the large majority of the phosphorus dissolved in runoff water. Although a smaller proportion of the nitrogen was organic, it was still the majority. This suggests that just measuring the inorganic nitrate and phosphate in runoff samples is insufficient to understand the nutrient losses by this pathway.

The next step will be to analyze the data to determine what effect of the cover crop treatments had on the nitrogen and phosphorus concentrations in the runoff in both organic and inorganic form. We are also currently soliciting collaborating farmers who have fields where the soil test phosphorus exceeds 200 FIV for us to conduct runoff analysis on with and without cover crops of the farmer's choice.

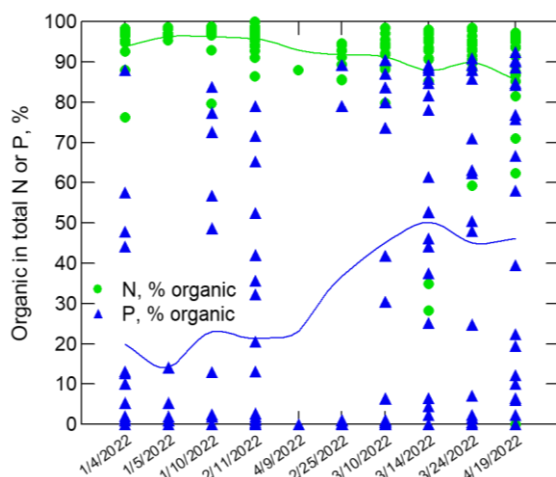


Figure 1 Ammonium was determined after filtration using the Endol Blue colorimetric method. Nitrate was determined by the salicylic acid method. Total N was determined by nitrate after alkaline persulfate digestion at 120 °C for 30 minutes in an autoclave.

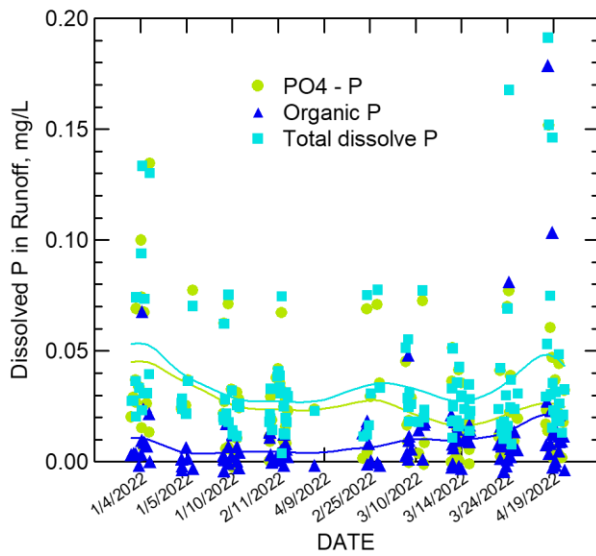
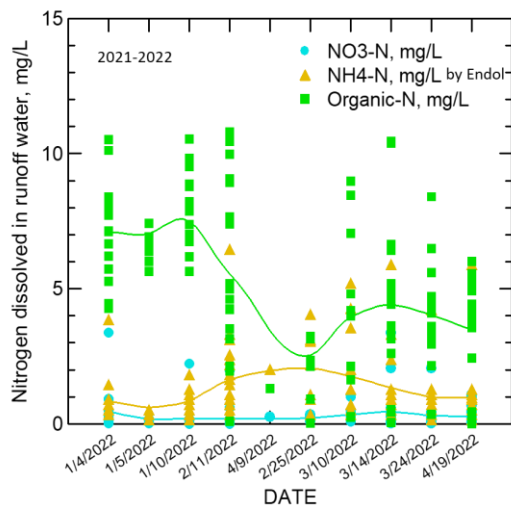


Figure 2 Most dissolved P was inorganic, but the share of organic forms increased in spring runoff. The total concentration of P dissolved in the runoff varied little on average, but individual samples had nearly 200 microgram/L (0.2 mg/L) of total P.



Generally, nitrogen was about 100 times as concentrated in the runoff as phosphorus (note the vertical axis scales in the graphs below). A larger percentage of the total dissolved nitrogen was in organic forms compared to phosphorus. Measuring just nitrate in runoff water misses most of the nitrogen dissolved in it. Measuring just the dissolved phosphate misses less than half, but still a significant portion of the phosphorus dissolved in the runoff.

