How much fertilizer are you removing from your turf?
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We fertilizer turf to replace nutrients as they become unavailable to the plant. That can occur when nutrients are taken up by other organisms, bound tightly to the soil, or are lost to the environment. Another major source of nutrient loss is from direct removal while mowing and hollow-tine aerating.

Many turf text books state nitrogen fertilizer application rates can be reduced by as much as 50% when clippings are returned. This is supported in numerous research studies that have been summarized in Frank and Guertal (2013). But how much actual fertilizer is being removed during mowing and aeration? It's a simple calculation. Just multiply the dry clipping weight by the amount of nutrient in the clippings (tissue testing). The following are a few examples from our research data.

- We measured the total clipping yield on a tall fescue lawn plot in Nebraska. The plot was fertilized with 4.0 lbs of nitrogen (46-0-0) annually and mowed normally or scalped all season long. At the end of the year, the normally mowed plots produced 70 lbs of dry clippings per 1000 square feet and 115 lbs of clippings when scalped. Assuming the leaves averaged 3% nitrogen by weight, **we removed between 2.0 and 3.5 lbs of N per 1000 square feet** by collecting clippings during mowing. If we assume the leaves averaged 0.5% phosphorus and only 2% potassium, **between 0.8 and 1.3 lbs of P_2O_5** and **1.7 and 2.7 lbs of K_2O fertilizer were removed per 1000 square feet annually.** Those nutrients needed to come from the soil because a 100% nitrogen source fertilizer was used. This slowly depletes the soil nutrient levels.

- Many golf courses are beginning to monitor clipping volume on putting greens in 2018. They are doing it for many reasons, but one is to estimate how much nutrient is being removed during mowing. A course provided me their 2017 clipping volumes for some quick estimates of nutrient removal. Assuming 3% tissue nitrogen again, that course removed approximately **2.3 lbs of nitrogen per 1000 square feet** during mowing. The weekly estimated nitrogen removal varied between 0.08 and 0.19 lbs per 1000 square feet, depending on growth rate. Interestingly, this estimated removal was significantly greater than the amount of nitrogen fertilizer they had applied. That difference came from mineralization of soil organic matter but soil microbes.

- Another way to remove fertilizer from a turf system is through aeration. Soil is heavy. Seemingly small amounts of soil organic matter (by weight) can be a lot of fertilizer. The top 3 to 4 inches of soil (average tine depth) weighs approximately 23,000 lbs. If that soil averages 1 to 3% organic matter, that equates to 2,300 to 6,900 lbs of organic matter. Assuming roughly 5% of the soil organic matter is made up of nitrogen, there is between 110 and 350 lbs of nitrogen locked in the soil organic matter. Remove 5% of the surface with hollow-tine aeration and you've **now removed between 6 and 17 lbs of nitrogen per 1000 square feet**, part of which (typically ~3%) could have mineralized back to plant available nitrogen forms in the future.

Removing clippings and aeration cores can significantly impact fertility requirements. Clippings should be returned whenever possible to improve nutrient cycling. Remember they don't cause thatch.

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