Maximum Economic Rate of Nitrogen (MERN)

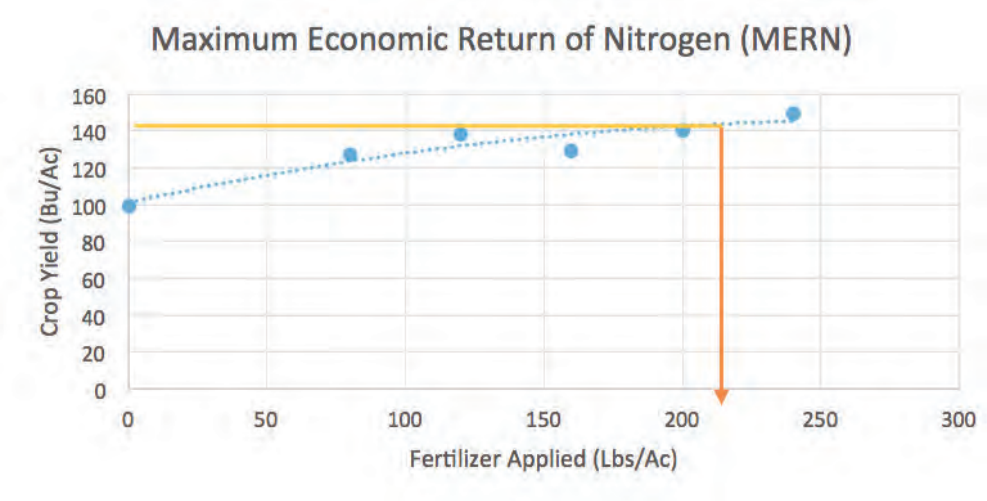
Finding the Target for Your Fields

Nutrient efficiency is as important for your bottom line as it is for the environment. When you apply too much nitrogen, you risk losing a significant amount to leaching, volatilization or runoff—which means you've paid for nutrients that could end up contributing to water or air pollution without benefiting your crop. If you apply too little, you are denying your crop the opportunity to reach its profitability potential.

The Maximum Economic Rate of Nitrogen (MERN) is a calculated value that indicates the point at which investing in more nitrogen (N) starts yielding less income per dollar.

Under good growing conditions, crops will still respond to more nitrogen with yield increases beyond the MERN value. However, every additional dollar invested in nitrogen after that point returns less profit.

MERN is a great measure of the optimum rate for crop, site and conditions. Rate is one of the 4Rs of Nutrient Stewardship—the right source, at the right rate, at the right time and in the right place—so understanding MERN helps fine-tune the 4Rs for your farm.



The figure above illustrates a MERN worksheet for a demonstration plot on the Kevin and Dan Harms farm in Livingston County, Illinois, in 2012. The Crop Nutrient Response Tool developed by the International Plant Nutrition Institute (IPNI) calculates several response curves, then identifies where the return on nitrogen investment starts to level off. That's the MERN.

Variations in MERN

Because MERN factors in crop growth, applied nitrogen, commodity prices and nutrient costs, it can be a highly variable number from field to field or from year to year.

For instance, MERN values calculated for corn on Marcus Meier's farm in the Indian Creek watershed in 2012 indicated that the maximum economic return was achieved at just 62 pounds of N per acre. That's because corn was not responding to nitrogen during the extremely dry 2012 growing season, so adding more N to a stalled crop would not have created greater profit.

By contrast, calculating the MERN on a nitrogen use efficiency demonstration on the same farm in 2014 indicated that the optimum topdress N rate was 159 pounds of N per acre (contributing to a total N application for the season of 199 pounds per acre). Comparing the plot's yield to a check plot that received no N that season, every 2.58 pounds of applied N contributed one bushel of corn, adding 77 bushels per acre to the hopper before yield response started tapering off.

MERN values also reflect current markets. In 2012, they were calculated on the assumption of corn values of $4.00 per bushel and nitrogen prices of 50 cents per pound. Just as weather conditions change from year to year, impacting MERN, prices will likely lead to different rates from crop to crop.

MERN in the Indian Creek Watershed Project

In the course of analyzing the extensive series of demonstration plots and field trials in the Indian Creek Watershed Project, organizers calculated MERN for dozens of crops.

Among the findings is that fall applications of nitrogen often exhibited lower MERN values than spring applications or split applications in the same field. This reflects losses of fall-applied N, reducing nitrogen efficiency.

MERN calculations for Project plots are available in the annual reports from the Indian Creek Watershed Project. If you would like to calculate your own MERN values, IPNI's Crop Nutrient Response Tool is accessible online at **http://phosphorus.ipni.net/article/NANE-3068**.

For more information on the 4Rs of Nutrient Stewardship, visit www.nutrientstewardship.com. For information about the Indian Creek Watershed Project, visit **www.ctic.org/IndianCreek** or call CTIC at (765) 494-9555.

Produced by the Conservation Technology Information Center (CTIC) www.ctic.org
Funding provided (in part) by the Illinois EPA through Section 319 of the Clean Water Act.